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ABSTRACT

A case study was conducted of attitudes toward technical drawing and the present state of technical drawing in Zimbabwe. The study involved two high schools. In one school, 227 students (85 percent of the total) responded to questionnaires; in the other, the response was 84 students (70 percent). Eleven teachers were also surveyed. The study indicates that attitudes toward technical drawing in the schools studied are positive. However, the study also points out that schools face problems such as shortages of books and teachers, which threaten the state of the subject as well as attitudes toward it. The study also gives some recommendations and suggestions for the improvement of the teaching of technical drawing in Zimbabwean schools. Although the technical drawing results of this study are not representative of the situation in all schools in the country, they at least indicate areas that need some consideration, and provide an indication of what may be expected in similar schools. The results should form the basis of future studies. (The document includes 18 references, definitions of terms, and the questionnaires.) (Author/KC)

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Attitudes towards technical drawing as a school subject

George Chinzvimbo

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ATTITUDES TOWARDS TECHNICAL DRAWING AS A SCHOOL SUBJECT

George Chinzvimbo

DISSERTATION
submitted as partial fulfilment for an
MA DEGREE IN TECHNICAL GRAPHICS EDUCATION

UNIVERSITETET I LINKÖPING
Institutionen för pedagogik och psykologi
RAPPORT LiU-PEK-R-135

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This is a case study of attitudes towards Technical Drawing and the present state of Technical Drawing in Zimbabwe. The study involved two schools. Data was collected through questionnaires and interviews. The study indicates that attitudes towards Technical Drawing in the schools studied are positive. However the study also points out that schools face problems eg shortage of books and teachers, which threaten the state of the subject and also attitudes towards it.

The study also gives some recommendations and suggestions for the improvement of the state of the subject in Zimbabwean schools. Although the results of this study are not representative of the situation in all schools in the country, they at least indicate areas which need some consideration and provide an indication of what may be expected in similar schools. The results should form the basis of future studies.

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FOREWORD

This Master of Arts dissertation was prepared within the framework of a bilateral cooperation project between Sweden and Zimbabwe. The Swedish International Development Authority - SIDA - provided financial support for the project.

Linköping University has been responsible for the education in cooperation with the University of Gothenburg. Fifteen students participated in the programme. Three students completed the main part of their education at University of Gothenburg. Twelve students completed their education at Linköping University.

For the twelve Linköping University students, the Department of Crafts and Design held the major responsibility for the courses. The exceptions being the course in research methodology and the actual preparation of the dissertations where the Department of Education and Psychology was responsible. Facilities for the fieldwork were provided by the University of Zimbabwe.

The Department of Crafts and Design has been the host department and responsible for the administration and coordination of the programme.

Linköping May 16, 1989

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Head of Department
Dept of Crafts and Design

Lars Owe Dahlgren
Professor and Examiner
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BACKGROUND AND PURPOSE OF STUDY

Traditionally, Technical Drawing has included plane and solid geometry, orthographic projection and common pictorial projections. The drawings have mostly been workshop-based related to craft subjects like Metalwork, Woodwork and Building. Over the years, Technical Drawing has developed to such an extent that it now includes topics far removed from craft: it has become a subject in its own right.

As Technical Drawing divorced itself from the crafts and became a subject in its own right, people began to question its position within the school system. This question is still unresolved in many countries - including Zimbabwe. Hence the need for studies such as this one.

Two viewpoints exist. There are those who believe that even if Technical Drawing is afforded full subject status it should continue to have very close links with practical subjects. This means that Technical Drawing students should also study either Woodwork, Metalwork, Building or related engineering courses. The argument is that unless Technical Drawing is related to practical subjects, students will have difficulty in understanding the subject. Technical Drawing needs to be linked to practical subjects to give it relevance. The second point of view is that it is not necessary to link Technical Drawing to Metalwork, Woodwork or Building. Technical drawing can be taught as an independent general education subject.

Literature indicates that in a number of countries Technical Drawing follows one of these two distinct lines. It is offered as an independent general education subject or as a pre-vocational subject. In the first instance emphasis is on how the subject develops the student cognitively although manipulative skills are also valued. When Technical Drawing is taught as a general education subject, its aims are no longer those related to the learning of a trade, but those related to the cognitive development of a child.

In the second instance emphasis is on how to perform specific tasks which assist in the learning of practical subjects like Metalwork, Woodwork, Building etc. In the majority of cases the subject has a strong bias towards mechanical engineering, architecture or electrical engineering.

In Zimbabwe, schools offer Technical Drawing either as engineering or building drawing. Engineering drawing consists of geometrical graphics and engineering graphics. Building drawing consists of geometrical graphics and building graphics. Whether Technical Drawing should be a pre-vocational subject linked to such subjects as Woodwork Metalwork or Building, or a

general education subject is not stated. In some schools, although it is given full subject status, it is offered to students who take either Metalwork, Woodwork or Building. In other schools it is taught as as a completely independent subject and the students take it as their only technical subject.

Over the years a lot of changes have taken place. Some schools which once taught the subject up to G.C.E. Advanced Level, no longer do so whilst a good number of schools have just started offering the subject. There are schools which have been provided with equipment to enable them to start a few classes of Technical Drawing but in some cases the equipment is not in use. There are also schools which have been offering the subject for a number of years but do not have permanent teachers for the subject. These schools rely on student teachers they are often unable to retain after the completion of their training.

The position of Technical Drawing in Zimbabwean schools requires a special study so as to crystallize the position of the subject.

The Technical Drawing syllabus used in Zimbabwean schools has not been revised for a long time. Its relevance to the present situation in Zimbawbwe has not been assessed. At the moment, the Curriculum Development Unit is in the process of localising all examinations. This means preparing syllabuses which are well suited to the Zimbabwean situation. (The Technical Drawing syllabus has yet to be localised) Before any changes are made, a study needs to be carried out to find out whether people are satisfied with the present syllabus or whether they feel, as in a lot of countries, that the syllabus is due for change. Whatever changes are to be made, the aims of the subject and the correct approach must be clear to everyone. This means that it must be clear whether the subject is a pre-vocational or a general education subject. Peoples' views must be known before any approach is prescribed.

Recently there has been a sudden increase in the number of schools offering Technical Drawing. One wonders whether the sudden increase means a corresponding increase of genuine interest in the subject. On the other hand, the lack of teachers, books, equipment, suitable furniture,the drastic drop in the number of schools offering 'A' level Technical Drawing and the Technical Drawing kits gathering dust in the store-rooms of some of the schools, make one wonder whether these are genuine hardships or are partly the result of attitudes.

General knowledge of attitudes towards Technical Drawing in Zimbabwe will help solve problems related to the provision and teaching of Technical Drawing and other graphics courses. This knowledge will inevitably spread to other parts of the world and thus help to stabilize the position of the subject in the world.

Governments in several countries are working tirelessly in an effort to create positive attitudes towards technical education of which Technical Drawing is part. This is mainly because they believe that the future of their countries largely depends on their technological development. The presence of technical subjects in schools is seen as the foundation stone. In Sweden, positive attitudes towards technical education has been achieved by providing opportunities for advancement to all students with high school technical qualifications. The level of technical education provided is so high that students are quickly absorbed into the eagerly waiting industries and those wishing to pursue their studies are quickly taken into the technical universities. Hultin (1987) affirms that this demand by both industries and institutions of higher education has done a great deal towards the creation of positive attitudes towards technical education in Sweden.

Establishing positive attitudes in people is essential for the successful implementation of any programme. It is important that those who implement programmes also have positive attitudes, otherwise the implementation will be a failure. Those who implement are also in a position to influence the people for whom the project is designed. In other words attitude is a very important factor when it comes to the implementation of a curriculum or a syllabus. Thus to stabilise the position of Technical Drawing and to enhance present and future implementation of drawing courses in schools, teachers', headmasters' and students' attitudes need to be known.

The purpose of the study:

The purpose of this study is to find out headmasters', teachers' (teachers of technical subjects in secondary schools) and secondary school students' attitudes towards Technical Drawing and to compare them to the state of Technical Drawing in the country.

For the definition of terms please see appendix I.

1. TEACHING APPROACH AND ATTITUDE

Since Technical Drawing is seen as a service subject to Metalwork, Woodwork and Building, people rarely view this subject as any different from these practical subjects. Generally people have the same attitudes towards Technical Drawing as they have towards Metalwork, Woodwork and Building. However people who are directly involved in education, like teachers, headmasters and students, have attitudes towards Technical Drawing which may be different from those they have towards Metalwork, Woodwork and Building especially if Technical Drawing is offered as an independent subject.

Attitudes towards Technical Drawing therefore, include those which are common to all practical subjects and those which are specifically attitudes towards Technical Drawing.

Although there are a number of factors which influence attitudes towards a subject, the one major factor which seems to influence peoples' attitudes towards Technical Drawing almost internationally is the teaching approach. Whether the subject is taught as a general education subject or as a pre-vocational subject, within the school system, has a major influence on whether people accept Technical Drawing or not. In other words one's philosophical position with regards to Technical Drawing influences one's attitude towards the subject. People who see Technical Drawing as a general education subject find it almost impossible to accept it when it comes in the form of a pre-vocational subject especially in the early years of secondary school. On the other hand, those who see Technical Drawing as a pre-vocational subject cannot accept its independence from the 'workshop' subjects.

In many countries Technical Drawing is taught as an independent subject and in some countries it has strong relations to practical subjects and engineering. In both cases the question often asked is: Why teach Technical Drawing in schools? The answer to this question is vital. The answer affects the syllabus, the approach to the teaching of the subject and peoples' expectations. The answer determines whether the subject is taught as a general education subject or as a pre-vocational subject linked to practical subjects. The answer to this question should be contained in the aims and objectives of the syllabus.

In Zimbabwe the question "Why teach Technical Drawing in schools? has not been answered in the syllabus. The subject holds different positions in different schools. The University of Cambridge syllabuses used at 'O' level and 'A' level in Zimbabwean schools do not state the aims of the subject. According to the University of Cambridge paper 'Trends in Technical Education' the types of examinations offered by the board are designed to satisfy both those who see

technical education making its contribution to society at an industrial/economic level and those who see it as a significant part in the social and intellectual development of the individual. It is therefore the responsibility of each individual country to decide on the role of Technical Drawing and decide on the correct approach. This is very important because if people are aware of the aims of a subject and are also aware that the teaching methods used are geared to fulfilling these aims, people are bound to have positive attitude towards the subject.

1.1 Technical Drawing as a general education subject

The essential differences between Technical Drawing as a general education subject and as a pre- vocational subject is that in the latter the learning is specialised and limited to specific areas. The emphasis is on how to carry out specific tasks. As a general education subject- especially in the early years of secondary school-it is mainly concerned with the development of the child as a whole, that is socially and intellectually. The syllabus includes more general graphics in addition to the usual geometry and engineering. Specialisation is purposely avoided, for it is argued that in today's fast changing technological world, no skills are valued indefinitely. The aim in general education is to equip the child with the necessary tools which will enable him to cope with the events of this world. The only tool which can assist him is the ability to think and adjust to changing circumstances. The child must therefore be taught to 'learn how to learn.' According to Krane and Dyson, Gurjouy (1981) a futurist psychologist claims that Tomorrow's illiterate will not be the man who cannot read and write, but the man who has not learned how to learn. (p 6)
Krane and Dyson (1981) refer to the pre- vocational approach as the 'tight thinking' approach and the general education approach as the 'loose thinking' approach.

Some countries have had to add new elements to the Technical Drawing syllabus in order to offer it as a general education subject. Technical Graphics/ Graphic Communication are examples of such efforts. However some believe that Technical Drawing can be offered as a general education subject without changing its content. This is justified by classifying Technical Drawing elements according to Blooms Taxonomy.

According to the classification of Technical Drawing elements by the Schools' Council: Craft, Applied Science and Technology Committee following Blooms Taxonomy (1969, pp 39-46), Technical Drawing involves a range of behaviour, from recall of knowledge and manual skills, to the more sophisticated processes of analysis, synthesis and evaluation.

Recall of knowledge includes recall of terminology, knowledge of geometrical facts; knowledge of engineering facts; knowledge of conventions and knowledge of principles eg. principles of orthographic projection and pictorial projections.

Techniques and manipulative skills: these include use of drawing instruments and free-hand sketching.

Intellectual skills and abilities include the following:

a) Comprehension, that is, understanding what is being communicated. Comprehension includes the ability to translate and interpret. Translation involves the ability to change from one form of communication to another. A good example is drawing from a solid object to orthographic or from pictorial to orthographic. Interpretation involves meaningful rearrangement of material eg. selection of views for effective communication and the ability to decide when a particular view is necessary eg a section or an auxiliary view.
b) Application: Application involves the ability to apply knowledge acquired to unfamiliar problems.
c) Analysis: This is the ability to breakdown material into its constituent parts and be able to detect the relationships of the parts to one another and to the whole eg exploded views of objects.
d) Synthesis: Involves putting together of geometric concepts and mechanical elements in such a way as to constitute a pattern or structure not clearly there before eg designing a mechanism or a machine to perform a specific operation.
e) Evaluation: Evaluation involves the making of judgements about the value of ideas, work, solutions, methods and materials.

Should Technical Drawing be a general education subject it is no longer a subject of the future draughtsman, technician or engineer only, but a subject for all students regardless of gender or future career aspirations. The function of Technical Drawing as a general education subject is clearly explained by Krane and Dyson (1981, p14).

> Drawing enables the learner to develop a method of visualising ideas and concepts through visual thinking. Graphic means can be used for developing the learner's capacity to discriminate, recall, organize, imagine and express knowledge and information -- it is a means of processing thinking and making learning more meaningful.

Technical Drawing assists students to initiate and develop thoughts and to communicate these to others. Drawing, like a language, is a necessary means of communication. Without the ability to draw and develop ideas or interpret the thoughts of others when expressed graphically, the capacity for communication

in this modern world is seriously curtailed. It seems therefore that offering Technical Drawing as a specialist subject to a few students is actually denying some students knowledge of one of the most essential means of communication. Green (1985), author and teacher, contends that:

> The skills involved in manipulating spatial concepts and ideas through graphical analysis and their contribution to the development of the thinking process, have long been underrated in education.---Drawing is not simply a passive recording of what we see, it is a dynamic experience of the transfer of thinking into visual terms without the unnecessary intermediate stage of words. Thus graphical development provides for direct visual analysis and the formation of relationships. (p 43)

Teaching Technical Drawing as a general education subject does not mean that it becomes an abstract subject. Most of the work students do is and should be related to life situations. Students should be able to apply what they learn in school to solving everyday problems. For instance, in addition to the emphasis placed on the educational values of Design and Communication (design drawing) ie the way it develops the student, emphasis is also placed on the importance of drawing in designing. Drawing helps the designer to think visually, to evolve hypothesis for consideration as possible solutions to a problem. Drawing is seen as a means of cognitive modelling, which means ideas, imaginations etc are given structure and shape by way of sketches and drawings. In this way the designer is engaged in a graphical dialogue with himself and with his partners.

Advocates of Technical Drawing as a general education subject contend that Technical Drawing as a pre-vocational subject serving Metalwork and Woodwork for example is not taught at a high level. Education of Craft subjects as pre-vocational has come to mean the teaching of basic manual skills. This kind of education is usually associated with some particular sections of the population. Wilms (1986, P91) argues that Vocational education's low status derives from its being disprortionately targeted on low-income minority students.

Dodd, (1978 p 23) contends that Manual training was a feature of the education of a social class group and, as such, carried the status of the group. It was often the symbol of poverty.
Andrew O Urevbu (1988 p264) alleges that:

> ... today the best employment is obtained only through "academic" learning, and when the elite, the top federal government officials, advocate vocational expansion it is often for other people's children rather than their own.

As a pre-vocational subject in many schools, Technical Drawing is reduced to a basic skills subject. Students learn the basic drawing skills to help them acquire

the basic skills in the various trades they may be studying. It is regarded as a subject for those who are not very bright and as a result its content is reduced to basics. Basic drawing skills do not prepare a student for any occupation. No-one is interested in a school leaver with basic pre-vocational knowledge. Advocates of Technical Drawing as a general education subject firmly believe that Technical Drawing as a pre-vocational subject has very little to offer. Cummings (1985, p3) lists one of the problems of implementing technical subjects in many developing countries as the fact that such practical skills are badly taught. He argues that, what employers need is a good level of basic academic education on which they can build occupation skills.

This is confirmed by Lauglo (1985, p33). In Kenya employers in the private sector are often sceptical of the value of school-based technical training as a preparation for practical or technical jobs, They prefer instead persons who have been fully trained on the job.

As mentioned before, attitudes towards Technical Drawing are strongly influenced by the way people see the purpose of education in secondary schools. Some people believe that the true purpose of education is to broaden the mind, to offer children the widest possible range of choices and they believe that the only way to achieve this is through liberal education. In countries where this idea is paramount, more general graphics courses like Technical Graphics, Graphic Communication or Design and Communication are now taught in place of the traditional Technical Drawing. On the other hand there are those who believe that education has always been playing at life rather than participating in life. Students should be prepared for the world of work and there is no better place for this preparation than the school.

1.2 Technical Drawing as a pre-vocational or vocational subject

Advocates of vocational education see Technical Drawing as a tool of the engineer and the craftsman. As a result they cannot accept the independence of Technical Drawing. The chief examiner University of Cambridge (1989) argues that:

> Technical drawing is essentially a tool of the engineer or craftsman and should not be regarded as a separate entity or be self-contained. Engineering drawings are not produced just to be drawings, they are produced to enable the engineer, the Production Engineer, the Carpenter etc to make something.

As a pre-vocational subject, Technical Drawing is still offered as a subject with its own syllabus and examination but it is closely related to the workshop subjects. A closer look at Technical Drawing as a pre-vocational subject serving

subjects like Woodwork, Metalwork, Building and Engineering is necessary so that we can see how attitude towards the subject are influenced.

A well-trained engineer or technician must be able to make and read correct graphical representations of engineering structures, designs and data relations. Without this knowledge, communication amongst workers of all classes is impossible. As a pre-vocational subject, Technical Drawing becomes a specialist subject. Students study areas related to a particular trade/profession eg Metalwork, Woodwork, Building, Mechanical Engineering, Electrical Engineering, Architecture etc. Generally the core of the subject consists of plane geometry, solid geometry, graphical calculus, graphical statics and engineering drawing or architectural drawing.

Knowledge of geometry is very important, because a lot of engineering problems are solved geometrically. Students are expected to be able to apply their knowledge of geometry to some practical problems which arise during and after their course. Descriptive geometry provides a rigorous course in logical thinking. The course in Engineering Drawing usually involves drawing detail diagrams, assembly diagrams and sections. Students are expected to use this knowledge when presenting their own designs. Engineering problems which are sometimes solved algebraically can also be solved graphically. According to French et al (1984, p 9),

> There is a graphic counterpart for almost every mathematical procedure or method. One can graphically add, subtract, multiply, divide, determine powers and roots and solve problems by algebra or calculus quite easily as, in many cases as accurately as and sometimes more quickly than with symbolic mathematics.

The latest chapter to be added to this universal language is computer graphics usually referred to as CAD or CADD. (Computer Aided Drawing or Computer Aided Drawing and Design.) CAD has revolutionised the engineering industry. With CAD, draughtsmen can now save a lot of their drawing time. Draughtsmen draw a diagram once. There is no need for tracings because with CAD a diagram can be stored and recalled whenever it is required. The computer then is a very important addition to the drawing office both in schools and industry. The drawing board still has a place. Frederick Giesecke et al (1986) contend that a computer is capable of doing a great many things, but it is only an electronic device with no brain. It cannot think, and will do no more or less than what it is told to do. Draughtsmen will continue to be in demand. They will spend most of their time on more important jobs and leave the repetitive tasks to the computer. The presence of the computer actually means additional knowledge of drawing is now required in order to write programmes for the computer.

Computers are now part of the equipment found in schools' drawing offices although their expense and the expense of the CAD programme tends to limit their availability.

In countries like the United States, Canada, and in the British colleges of further education and in vocational programmes like BTEC (Business and Technician Education Council) Technical Drawing is linked to the different branches of engineering but it is given full subject status.

It has a syllabus and an examination of its own. In Sweden however, students are given a basic general introductory course and thereafter they study the drawing related to their area of specialisation. The drawing is however, taught as and when required. Whichever way it is offered, Technical Drawing is an essential part of engineering. Giesecke et al (1986, p9) assert that:

> Today the intimate connection between engineering and science and the universal graphic language is more vital than ever before, and the engineer, scientist or technician who is ignorant of or deficient in the principal mode of expression, of his or her technical field is professionally illiterate --- training in the application of technical drawing is required in virtually every engineering school in the world.

It is essential that all engineers or technicians are able to think in three dimensions. The ability to visualise, and record and give shape and structure to images is an important requisite of every engineer or technician. Technical Drawing is an essential means of communicating design concepts and details of shape and size which cannot be communicated by written or verbal language or by the language of mathematics.

Offering Technical Drawing as a general education subject has meant in some cases, reducing some of its technical content and replacing this with such artistic skills as, shading, colouring, air brush techniques, shadow and surface texture. Changing Technical Drawing to a general graphics subject will according to Green op cit. " demean it as a 'technical' subject." Advocates of Technical Drawing as a vocational subject favour Technical Drawing as a 'technical' subject and detest the inclusion of artistic skills. Technical Drawing with strong engineering links they say can stand its ground both as a vocational subject and as a general education subject. Technical Drawing, it is claimed, is the only graphics subject which uses mathematics in its presentation of ideas. This is done by analysis of points and lines in space which are then synthesised to form images of solids. A three dimensional object is thus transformed on a two dimensional medium of a sheet of paper. The use of orthographic projection enables the designer to realize his abstract images in a concrete and communicable way. Technical Drawing does not need to be transformed into an art- based subject to make it educationally sound nor does it need to be isolated from practical subjects to be educationally valid. If it has to grow, then more

engineering (technical) areas should be included. Besides its vocational attributes, Technical Drawing has a lot to offer academically. Its educational attributes, according to the Schools Council's Craft, Applied Science and Technology Committee (1969) include the following:

a. It develops the power of spatial thinking.
b. It provides graphical solutions to problems and often implements mathematical studies.
c. It gives point to and illuminates studies in other fields.
d. It has direct links with practical applications, and its vocational links provide strong motivation.
e. Technical Drawing is a link between academic and practical subjects.
f. It is a means of (two way) communication.

At advanced level, Technical Drawing is applied Mathematics in a graphical form. In a study of the 1984 examination results of Kabete secondary school in Kenya, Lauglo (1985) found that there was high correlation between Mathematics and Technical Drawing and Technical Drawing and Science.

Today vocational education programmes with broad based vocational education are provided. This is education which, in addition to the preparation of a student for the world of work, also gives the student general education to broaden his mind. Vocational education which provides only basic skills is now a thing of the past in some countries.

1.3 Current developments in Technical Drawing

Efforts are being made in many parts of the world, to bridge the gap between Technical Drawing as a general education subject and Technical Drawing as a vocationally oriented subject.

Today a lot of countries have either moved away from the traditional Technical Drawing courses or have added new elements. They have developed courses which suit the needs of their countries. Courses like Technical Graphics, Graphic Communication and Design Graphics are now offered in different countries. The University of Cambridge (1983) , pointed out that: In the United Kingdom, as technical education moved more and more towards design education, it was realised that to communicate ideas and information over a range of specialisations, a knowledge of geometrical constructions and engineering drawing alone was not sufficient. Technical Graphics and Graphic Communication courses were introduced. These courses provided a wider range of graphical techniques such as perspective projection, shading, colouring, packaging design, advertising materials, computer graphics, electrical and map drafting. They still included the traditional elements of plane and solid geometry, engineering and building drawing. In 1986, further

changes took place, design and communication replaced these later developed courses and once again, links with craft subjects have been strengthened. The traditional elements of Technical Drawing ie geometry, engineering and building drawing no longer form the core of the subject but they are taught as and when required.

According to the pamphlet "Welcome to Graphic Communication " a supplement to the Technology Studies bulletin number 3, September 1982, schools in the Australian Province of Victoria offer general Graphic Communication courses in the early years of secondary education. Students who are interested can continue with Graphic Communication to high school level or may elect to take one of the specialised courses of engineering and architectural graphics.

In 1984 a survey was carried out in some British schools by Her Majesty Inspectors (HMI) to find out the position of Technical Drawing. Industries and colleges of further education were consulted in order to ascertain their expectations from school leavers. A number of recommendations were made and since these can be applicable to many other countries, it is worth noting them. All those consulted agreed that the content of drawing courses need to be related to the practical experiences of students. Drawing needs to be seen as part of a design process, and an essential part of the making and manufacturing process as well as a system of communication and recording of ideas. They all expect students to demonstrate an ability to: (HMI) 1984.

1. Communicate ideas, facts and trends in the most appropriate graphic form.
2. Read, understand and interpret working drawings and charts of various kinds.
3. Make a free -hand dimensioned sketch.
4. Use graphic means when appropriate to solve problems and to convey numerical relationships.
5. Understand the use of scale, tolerances, conventions and symbols as used in engineering or building drawing.
6. Present any form of graphic work as accurately as a particular purpose requires.

Technical Drawing (Design and Communication) in the United Kingdom is now taught as part of Craft Design and Technology. It only becomes a separate subject in the fourth year. (Equivalent of Form 3 in Zimbabwe)

To find out the latest developments in Technical Drawing as a general education subject, the researcher made enquiries to two examination boards in Britain and, for the latest developments in Technical Drawing as a vocational subject, to the Business and Technician Education Council (BTEC) also in Britain. (See appendix II)

One question was whether Technical Drawing students should also study subjects like Metalwork or Woodwork and not Technical Drawing on its own. One of the boards replied that it was not necessary that Technical Drawing be studied together with practical subjects like Metalwork or Woodwork. Technical Drawing is a useful subject for general education purposes. However, the board pointed out that the introduction of Technological studies and Craft and Design will lead to the phasing out of full Technical Drawing courses. They will be replaced by Design and Communication. Design and Communication courses emphasise sketching and presentation and include elements of Technical Drawing.

The other board pointed out that Technical Drawing no longer exists as a separate subject in the United Kingdom. It is regarded as a tool in other subjects involving wider ranges of methods of communication. On the general role of Technical Drawing in a student's life, one of the boards believes that Technical Drawing contributes to students' personal development in that it instils in students a discipline of logical thought and a requirement to present ideas of shape and size in an orderly and neat manner.

In reply to a question on whether Technical Drawing should stand as a subject of study in its own right, the Business and Technician Education Council said this cannot be done at tertiary level. At this level, the interest is on drawing of a related vocational nature, and not on drawing techniques. Drawing courses include architectural detailing, electrical services detailing, plant layout detailing and structural detailing. These form 20% to 30 % of a course of study. Unless the drawing input is related to something (eg road layouts, structural assemblies, printed circuitry designs, engine assembly) it is likely to be of little lasting interest to students. On the personal development of a student, BTEC stated that : "Drawing helps to develop a disciplined and logical approach to addressing situations that are variable. Once students realise that drawing can be used to communicate information from one person (not necessarily themselves) to another, they will begin to see that a "technical" drawing is a working document. Also, since a variety of ideas can be tried out in graphic form (both manually and computer aided) students will appreciate drawing as a means of evaluation"

On the use of computers, BTEC contends that manual drawing will be complemented rather than supplemented by computer graphics. The development of computer-aided design will influence Technical Drawing, but the retention of graphical skills in technical courses will continue to be necessary for at least the next 10 to 15 years.

In Australia, according to Morgan (1983), Technical Drawing is taught across most states. It takes different forms though, which vary from "... a more liberal

interpretation in the form of graphics or graphical representation to the somewhat "classical" Technical Drawing."(p 6). In a majority of the Australian states, general Graphic Communication courses form the foundation of the courses offered in the early years of secondary school, and Technical Drawing with an engineering or architectural bias is offered in the senior secondary school. The philosophical position of the various Australian states seem to determine the type of drawing courses offered in the schools. For instance Tasmania sees its manual arts as traditional, skill-centred, with a problem-solving approach. It offers Technical Drawing. South Australia sees technical subjects as part of a general education and it offers Graphic Communication. Western Australia sees technical subjects as general education subjects with a pre-vocational element. Western Australia offers Technical Drawing.

In Sierra Leone, although there also exists the controversy of Technical Drawing as a general education subject and as a pre-vocational subject, attitudes amongst students towards Technical Drawing are positive. Write (1986), states that, studies on attitudes towards practical subjects carried out in Sieera Leone indicate that contrary to the general belief that students are anti-technical subjects, results showed that students do have positive attitudes towards technical subjects. Results further showed that students have more positive attitudes towards Technical Drawing than Metalwork and Woodwork. In Africa, according to studies carried out in Kenya by Lauglo (1985) and in Sierra Leone by Write, (1986), an additional source of miscontent with technical subjects including Technical Drawing seems to be that these subjects seem to lead nowhere except to lowly paid jobs -if they are available. Write (ibid) argues that practical subjects are not recognized by universities as entry qualifications for any courses.

> ...while many pupils are ready to accept that they may not succeed in entering university or achieving their preferred career aspirations, they are not willing to forfeit the opportunity to "have a go" at these objectives. (p 133)

For this reason, students prefer academic subjects which seem to provide the route to a "bright future"

1.4 Conclusion and research objectives

The literature review potrays a picture of the position of Technical Drawing and other graphical courses as school subjects in different countries The factors discussed are the factors which seem to affect attitudes towards Technical Drawing in these countries. The same factors may have an influence on attitudes towards Technical Drawing in Zimbabwe. In addition to these "international" factors, other factors which include teaching methods, academic relevance, practical relevance and relevance to future career aspirations,

availability of teachers and equipment, will be looked into to see if they have any effect on attitudes towards Technical Drawing in Zimbabwe.
Briefly, literature indicates that factors which seem to influence attitudes towards graphics subjects include:

1. Personal development of the student ie cognitive and manipulative skills provided by the subject.
2. Future academic and vocational prospects provided by the subject.
3. Relevance of the syllabus to related situations in a country.
4. Possibilities of immediate application of knowledge acquired.
   ie The possibility of applying the knowledge learnt in solving everyday problems at school and at home.

Lack of qualified teachers, equipment, and books can influence attitudes if they seem to be a permanent feature.
The factors listed above will form the basis of this study.

Research objectives:
Objective: A. To find out headmasters', teachers' and students' attitudes towards Technical Drawing and to compare them to the state of Technical Drawing in their respective schools.

Objective B. To find out whether headmasters, teachers and students prefer Technical Drawing as an independent subject with emphasis on the cognitive development of the child, or as a pre-vocational subject related to Metalwork, Woodwork and other technical subjects.

Objective C. To establish teachers', headmasters' and students' views on the content of the present 'O' and 'A' Level Technical Drawing syllabuses, and their suggestions for the improvement of the subject content and the teaching of the subject.

The study was limited to school headmasters, teachers and students. To facilitate quick distribution and collection of questionnaires and frequent visits, the study was carried out in the Harare region. Because of the limited time available to carry out the study, other relevant institutions and people were left out.

2. METHODOLOGY

2.1 Description of method

No study of attitudes towards Technical Drawing as a school subject has been carried out in Zimbabwe. To pave the way, it was decided to carry out a case study of two schools. A case study was decided upon so as to make it possible to identify key issues related to attitudes towards Technical Drawing in schools. Although the findings of this study are not generalisable, they will open out the area to future studies. At this stage a case study was felt to be the best design because it enables one to carry out a close study of issues which may not be possible in a large scale study. In addition, a case study was felt to be the most appropriate design to adopt because of the limited time available for the study. According to Bell 1987,

> The great strength of the case study method is that it allows the researcher to concentrate on a specific instance or situation and to identify, or attempt to identify, the various interactive processes at work. These may remain hidden in a large scale survey but may be crucial to the success or failure of systems or organizations.

in Technical Drawing

Since this is, as far as the researcher is aware, the first study of its kind to be conducted in Zimbabwean schools, a case study will make it possible to generate data which will form the foundation for future studies. Selltiz et al 1959 confirm that a case study approach is generally useful in bringing to light relationships that can be further studied using other methods. A case study has been chosen in spite of some of its limitations- which include the fact that findings cannot be generalised- because this limitation is out-weighed by the fact that a case study will establish a foundation on which future studies will be based.

2.2 Subjects

To carry out a close study of attitudes towards Technical Drawing, two boys high schools were chosen. One of these schools initially operated as a technical high school. Academic subjects were, however, also part of the school's curriculum. The other school has a strong academic background, although here too technical subjects have always been part of the schools curriculum. Today these schools are no longer categorised as academic or technical high schools. They are simply high schools offering both academic and technical subjects. The schools have the same responsible authority which puts them on the same footing financially. They have both been teaching Technical Drawing for over twenty years. Today they are two of the few schools offering the subject at Advanced Level.

The two schools shall henceforth be referred to as school (A) and school (B). School A is the school with the longer technical background and school B is the school which initially placed more emphasis on academic subjects than on technical subjects. Although these schools are now offering both academic and technical subjects without special emphasis on either, school B has a smaller technical department.

The study was limited to these two neighbouring schools in order to facilitate quick distribution and collection of questionnaires and also frequent visits. The schools were also selected to see whether there were any differences in attitudes towards Technical Drawing in the two schools.

The respondents in these two schools included students, teachers of technical subjects ie Technical Drawing, Woodwork, Metalwork and Building. Headmasters were also chosen as subjects.

In the case of students, these included, in school A, students in Forms 1 and 3. Forms 2, 4 and the Upper Sixth Form were not included in either school because they were busy with their end of year examinations. The total number of students in school A were 148 in Form 1 and 118 in Form 3, making a total of 266. School A did not have a Lower Sixth Form class in 1988.

In school B the subjects included 35 Form One, 69 Form Three and 16 Lower Sixth Form students making a total of 120 students.

In both schools, only classes which had Technical Drawing as one of their technical subjects participated in the research.

A total of 6 technical subject teachers and the headmaster were chosen as respondents in school A. In school B, 4 teachers out of a possible 5 were able to participate. This included the head of department who also represented the headmaster. The one teacher who could not participate was involved in the marking of the national examinations.

2.3 Instruments

2.3.1 Attitude scale

A Likert-like pretest attitude scale was prepared for students. The scale consisted of twenty items (see appendix IIIa and IIIb where the information sought by each item is also explained) For each item students had to indicate their degree of agreement or disagreement with the statement by underlining the words: Strongly agree, Agree, Undecided, Disagree and Strongly disagree.

The highest score for each statement was 5 and the lowest was 1. For a positive statement the allocation of points was : Strongly agree 5, Agree 4, Undecided 3, Disagree 2, and Strongly disagree 1. The opposite applied to negative statements.

Since headmasters need to be informed well in advance that a study will be carried out in their schools, it was not possible to choose a different school for a pretest of the Likert- like scale since only these two schools had been informed about the study. For this reason the group which was used for the pretest had to come from the same schools. A total of ten students from each of the eleven classes were randomly selected. The selection was done by putting in a box slips of paper with names of each student in a class. The papers were thoroughly mixed and then the required number of names were drawn. A total of 110 names were drawn from both schools.

Out of the 110 pretest students, 28 students, which is 25% of the total, with the highest scores and another 28 students with the lowest scores were selected. The mean for each item in both the top 25% and the bottom 25% was calculated and the differences between them found.

Table 1. Pre-test results of the attitude scale

Item	Top 25% Mean	Bottom 25% Mean	Differences
1	4.1	2.8	**1.3**
2	3.8	3.1	0.7
3	4.9	3.8	**1.1**
4	4.3	3.9	0.4
5	4.2	3.4	0.8
6	4.4	2.6	**1.8**
7	4.7	3.1	**1.6**
8	3.0	2.5	0.5
9	4.0	2.2	**1.8**
10	3.4	2.5	0.9
11	4.4	2.9	**1.5**
12	3.8	2.9	0.9
13	4.3	3.7	0.6
14	4.5	2.9	**1.6**
15	4.5	3.4	**1.1**
16	4.4	3.5	0.9
17	4.4	3.3	**1.1**
18	4.5	3.4	1.1
19	3.9	2.4	**1.5**
20	4.7	4.0	0.7

Items selected as those which differentiated best between the two groups are those with the highest differences. In this case 1 point or more. The final test consisted of 10 items which included items, 1, 3, 6, 7, 9, 11, 14, 15, 17, and 19. In order to end up with a round figure of ten items, it was decided to leave out item number 18. This item was left out because item 19 would give the information needed.

Briefly the selected items measured:

1. Item 1: Acceptance or rejection of Technical Drawing as the most important technical subject considering Metalwork, Woodwork and Building.
2. Item 3: Popularity and the acceptance or rejection of Technical Drawing.
3. Item 6: Acceptance or rejection of Technical Drawing as an Intellectually demanding subject.
4. Item 7: Acceptance or rejection of Technical Drawing as a general education subject useful and relevant to a student's further academic and professional studies.
5. Item 9: Appreciation or lack of appreciation of the relevance of Technical Drawing to Mathematics.
6. Item 11: Appreciation of Technical Drawing as a general education subject.
7. Item 14: Acceptance or rejection of some of the teaching method used in the teaching of Technical Drawing .
8. Item 15: The need or lack of the need for the inclusion of practical work in Technical Drawing
9. Item 17: Acceptance or rejection of the importance of graphics as a means of communication.
10. Item 19: Acceptance or rejection of some of the teaching methods used in the teaching of Technical Drawing.

The final scale consisted of the following items:
The objective to which each item belongs is indicated in brackets.

1. The most useful technical subject in this school is Technical Drawing. (Objective A)
2. If all students had a free choice, nobody would study Technical Drawing because it is a useless subject.(Objective A)
3. Students should spend most of their study time studying English, History, Mathematics, Geography and Science instead of Technical Drawing. (Objective C)
4. Technical Drawing will be very useful to me if I should decide to continue with my studies up to Form four /Advanced level/ University.(Objective B&C)
5. Technical Drawing helps me to understand Mathematics better. (Objective B&C)

6. Everybody should study Technical Drawing, even girls because it is a very useful subject. (Objective B)
7. Technical Drawing is not an interesting subject because it is full of rigid exercises and I'm not free to use my own ideas except to follow rules. (Objective C)
8. I hate Technical Drawing because I spend most of my time drawing diagrams of machine parts which I have never seen. (Objective B)
9. I wish our Technical Drawing course included more graphics topics like electrical drafting, map and computer graphics. (Objective A&C)
10. Most of my friends lose interest in Technical Drawing because there are too many strict rules, especially for beginners. I am expected to be able to draw lines which are perfectly straight and often the lines must be of different densities depending on what they represent. The lettering should be perfect. The letters must be of the same size and must be carefully printed. We are also expected to keep the drawing paper immaculately clean as if it has not been used. I think these rules must be relaxed for beginners. (Objective C).

In addition to the attitude scale, students had five other questions concerning their perception of Technical Drawing; syllabus content; teaching methods used by teachers and their career aspirations (see appendix IIIa and b).

2.3.2 Questionnaire and interview schedules

The teachers questionnaires consisted of twenty open-ended questions (see appendix IVa and IVb where the reasons for asking the questions have been provided below each question.)

The questions have been regrouped according to objectives (see appendix IVb) . Some of the questions belong to more than one objective and this has been indicated wherever it applies.

The interview schedule for headmasters consisted of the same questions as those contained in the teachers' questionnaires.

2.3.3 Reliability and validity

To ensure validity, questions were planned according to objectives. The study has three objectives and every question or statement in all the instruments belongs to one of these objectives. This method of ensuring validity is recommended by Borg and Gall (1983).

To ensure reliability, the students' questionnaire was pre-tested. As a result of the pre-test, questions which had been incorrectly interpreted because of the

wording were either eliminated or reworded. Bell (1983) recommends pre-testing of instruments as one of the devices for checking reliability. Questions which did not measure attitudes effectively were also eliminated. Before students completed the questionnaires, verbal explanations of how to answer the questions were given. The fact that the questionnaire was not an examination and that there was no right or wrong answer was emphasised to the students. Students were free to ask the researcher whenever there was anything they did not understand. Simple language was used in all the questionnaires in order to avoid any misunderstanding. Explanations were also given to teachers before they answered any questions.

The information sought by each question was clearly defined and noted and the questions were thus carefully worded so that no misinterpretations of the questions would arise.

Helmstadter (1964) points out that the subjects' general attitude influences reliability. Both teachers and students were very keen to provide honest and accurate information because they believed that this was a step towards the improvement of the subject and to achieve this it was important to give honest answers. Accordingly the researcher assumed reliable answers.

2.3.4 Administration of instruments

Preliminary arrangements for the study were made by the University of Zimbabwe. The university sought permission for the study to be carried out in schools from the Ministry of education. The schools selected by the researcher were contacted by the university. primary and secondary

The questionnaires were administered to students with the assistance of the class teachers, and at times, with the assistance of the heads of department. The researcher first explained to the students as a class how the questionnaires were to be completed. The students completed the questionnaires in class and they were all collected immediately after completion.

Teachers were issued with questionnaires by the researcher. These were handed over to the researcher or to the head of department after completion. Since the questionnaires required fairly detailed information, quite often teachers needed two or three days to complete them.

For the interviews, appointments were made in advance by the researcher. The researcher took notes during the interviews.

3. DESCRIPTION AND ANALYSIS OF RESULTS

Results are presented according to objectives.
Teachers and headmasters' responses have been presented first, followed by students' responses.

3.1 Headmasters' and teachers' responses

Because the number of teachers who participated in the study is very small, 7 from school A and 4 from school B, no statistical figures have been used to describe the responses. Responses have been presented verbally instead.

There is no difference between the answers provided by teachers in school A and those provided by teachers in school B. Accordingly all results will be presented together. Only when some differences exist will the results be presented separately.

3.1.1 Headmasters'and teachers' perception of the state and function of Technical Drawing (Objective A)

Quite often some subjects exist in a school's curriculum just because they have become part of the school's tradition. Subjects may be offered because early exposure to these subjects encourage students to consider careers in related areas. Quite often subjects are offered purely for educational reasons.

In giving reasons why their schools offer Technical Drawing, teachers and headmasters pointed out that the subject was offered because it was seen as an important subject both educationally and vocationally.

These two schools are two of the few schools in the country offering Advanced Level Technical Drawing. Teachers in these schools are not aware whether their schools started offering the subject at Advanced Level as a result of the school's own initiative, or whether the schools were advised to. In school A, the headmaster pointed out that 'A' Level Technical Drawing had always been available but soon after independence most of the teachers left. The subject was re-introduced at 'A' Level after an absence of four to five years. He explained that the main reason why a number of schools are not offering the subject at 'A' Level today is because teachers qualified to teach the subject at this level are not available. In school B students asked the headmaster to introduce the subject at Advanced Level.

The main reason why both schools have made an effort to offer the subject at 'A'Level is because the subject is considered a useful preparation for the Engineering degree at university.

Most schools in Zimbabwe practice streaming. The 'bright' students put more emphasis on subjects like Mathematics and Science whilst the academically weak put more emphasis on practical subjects. Technical Drawing is considered one of the practical subjects. In the two schools where the study took place the situation is rather different. Both schools have streaming but in school A the streaming does not affect Technical Drawing because Technical Drawing is a compulsory subject. All students in Form one, two, three and four study Technical Drawing. In school B streaming does exist, but Technical Drawing is given to the A and B streams which are the most able streams. Generally teachers consider Technical Drawing as an intellectually demanding subject and therefore they feel that the subject is best suited to the above average students. However, teachers also feel that even those who are academically weak need Technical Drawing knowledge and skills to help them in trades like motor mechanics, carpentry, building etc.

On the question of the subject's popularity, one of the headmasters emphasised that the subject is definitely not unpopular. Popularity or lack of popularity of a subject depends on the teacher. He said the teacher influences the students by his ability to teach, and by his attitude to the subject. All teachers generally agreed that Technical Drawing is quite popular amongst the students. In school B students often ask the headmaster for a transfer to the streams which take Technical Drawing.

The pass rate does not seem to match the enthusiasm of the headmasters and teachers. School A average pass rate at 'O' level is 65%, and in 1986 at 'A' Level the pass rate was 34.1% and in 1987 43.8%.
In school B average pass rate at 'O' level is 40%. School B had its first 'A' Level class in 1988 so no results were available.

Both teachers and headmasters agreed that the results are not very good and this is blamed on the lack of properly-qualified teachers, especially 'A' Level teachers. In many schools the subject is taught by student teachers who are unable to see the students through to the examinations because they only teach for a year. Teachers and headmasters also mentioned shortage of teachers as one of the major problems faced in schools. School A for instance, in 1988 had to send its Upper Sixth Form students to school B for their 'A' Level Technical Drawing lessons. Books are not available. A few old copies suitable for the 'O' level course are available but there is virtually nothing for the 'A' level course. Lack of books also features as one of the problems schools have with Technical Drawing. The change from AEB (Associated Examining Board) to

the Cambridge Examination Syndicate is said to have augmented the problem of text books because the differences in the syllabuses has, in some cases, brought about the need for new text books. Another problem cited is the question of localising syllabuses (although the Technical Drawing syllabus has yet to be localised) Suitable textbooks are not always available for these new syllabuses. Another reason given for the poor 'A' Level results is that quite often the good 'A'Level students choose subjects like Physics and Mathematics. Some students take the subject because they consider it a soft option and as a result do not spend much of their study time studying the subject. The fact that some students only start the subject in the Lower Sixth Form is also given as a contributing factor.

Regarding the funds for each subject,

It seems the government allocation for technical subjects is either shared equally or proportionately. (considering the cost of materials used). However, teachers expressed the fact that they do not have adequate facilities for Technical Drawing.

Considering the world-wide developments taking place both in industry and schools, headmasters were asked if their schools were in a position to introduce Computer Aided Drawing. Headmasters pointed out that although this was something they wished for, it was almost impossible financially.

Despite all these problems teachers and headmasters are all hopeful that the situation can be improved. Their suggestions for the improvement of the state of Technical Drawing in schools include a). Adequate provision of equipment and books and b) Appointment of properly-qualified teachers for the subject. Teachers in particular, feel that there should be a communication link between industry and schools, and between the Engineering Faculty at the university and schools, so that schools are made aware of the requirements of industry and the university. A few teachers suggested that headmasters should try to know more about the subject because with their understanding, the status of Technical Drawing in schools could improve.

3.1.2 Technical Drawing as a general education subject and Technical Drawing as a pre-vocational subject (Objective B)

Since the Cambridge Examination Board syllabuses used in Zimbabwean schools do not include aims, it was decided to find out what aims the schools have devised for themselves. Three of the teachers were unable to provide answers but those who did included the following.

School A:

a) To enable students to apply their knowledge of Technical Drawing to solve real-life problems.

b) To produce pupils who can communicate literally, numerically and graphically.
c) To prepare pupils for further training and also to improve their job opportunities.
d) To enable students to be able to read and understand diagrams.
e) To create in students a sense of relating drawing knowledge and skills to the wider context of society and socialist development.
f) To create a sense of design awareness.

School B:

a) Enhancement of: Manual skills, perception, social interaction, psycho - motor dexterity and discipline.
b) To develop creative skills in students.
c) To widen students'perception in reacting to problems.
d) To realise and develop drawing and problem-solving skills of pupils to the maximum.

As mentioned above, schools see Technical Drawing as an important subject both vocationally and academically.
The reasons given include the following : a) Technical Drawing is necessary for the understanding of subjects like Metalwork, Woodwork and Building. b) Technical Drawing is useful for further technical and academic studies.

On how Technical Drawing benefits the student both academically and vocationally, teachers seem to value both the academic and vocational relevance of Technical Drawing. Academically the subject assists in the understanding of Mathematics and Science. It is very useful to those who intend to study Engineering at university. Vocationally, the subject prepares students for self-employment. It is felt that after secondary school, students are in a position to prepare useful diagrams such as house plans. Students joining the world of work will find the subject very useful especially in engineering.

On the question of whether teachers see Technical Drawing as a subject for preparing students for employment or as general education subject, although some teachers pointed out that Technical Drawing is a general education subject, the majority feel that Technical Drawing is for preparing students for employment. Students will either be self-employed or they will join engineering companies. The main reason for emphasising the vocational aspect of Technical Drawing is that teachers believe that the country is in desperate need of people with technical knowledge and skills. Although emphasis on the vocational aspect of the subject means that Technical Drawing should be closely related to the workshop subjects, teachers feel that Technical Drawing should stand as a subject in its own right. They argue that if only areas which are strictly related to Metalwork, Woodwork etc are considered, it would mean leaving out those elements of Technical Drawing which are important but not

related to these practical subjects. One teacher in school B feels that the subject should be part of Metalwork , Woodwork etc in the early years of secondary school education. In the later years of secondary school, the subject can be offered as an independent subject but closely linked to engineering.

Teachers had mixed feelings about the idea of making Technical Drawing a compulsory subject for all students in all Zimbabwean schools regardless of gender or career aspirations. Half the teachers confirmed that they would go along with the idea of making Technical Drawing a compulsory subject. Their reason is that since Technical Drawing helps in the understanding of subjects like Mathematics and Science, and since these two are usually offered to all students, then Technical Drawing should be offered too. Those who said no, feel that Technical Drawing cannot be made compulsory because they believe that Technical Drawing is only useful to those who study other related subjects like Metalwork and Woodwork.

Lately, there has been extensive talk about 'Education With Production' and headmasters often use the practical subjects in their schools to show that they are involved in 'Education with production' Teachers and headmasters were asked whether they see Technical Drawing as a productive subject or not. Both teachers and headmasters feel that Technical Drawing is not productive on its own, but it is a means to an end. The production which takes place in Metalwork and Woodwork for example, starts on the drawing board. However, Technical Drawing students also prepare posters, direction signs and display signs. This is production.

Most of the teachers claim that they do give their students an opportunity to apply their knowledge of Technical Drawing. Examples given are Designing and Mathematics.

Some of them however, pointed out that there is a lot to be covered and there is just not enough time to allow students to tackle other problems than those directly related to the syllabus.

3.1.3 Teachers' and headmasters' views on the content of the present 'O' and 'A' Level Technical Drawing syllabus and their suggestions for the improvement of the subject content and teaching (Objective C)

Only teachers provided the information in this section because headmasters felt they were not in a position to comment on the syllabus content since they are not specialists in the subject.

Generally, teachers expressed satisfaction with the present syllabuses.

The majority of teachers admitted that they are not aware of other drawing syllabuses. Those who are aware of others rejected the idea of replacing the present Technical Drawing syllabus with some of these 'new' courses. The reason given was that teachers feel that there is need for Technical Drawing knowledge and skills in the country and the present syllabus satisfies this need adequately. Not many changes to the present syllabuses were suggested. Teachers feel that most of the topics in the Technical Drawing syllabus are important. If changes have to be made, perhaps "Lines In Space" could be removed because the topic is rather abstract. 'Auxiliary views' was another topic which could be removed because auxiliary views are rarely used. Perspective projection could also be left out because its not relevant to engineering. Teachers did not suggest any additions to the syllabus except the inclusion of design topics.
Teachers do not know whether the current syllabuses meet the needs of industry because there seems to be no link between industry and schools.

3.2 Students' responses

Out of the possible 266 students in school A, 227 (85%) questionnaires were returned. In school B, out of a possible 120 questionnaires 84 (70%) were returned. It was not possible to get a 100% response from students because the study took place at a time when students had just completed their end -of- year examinations. At this time of the year students' attendance at classes is erratic.

3.2.1 Students' Perception of Technical Drawing (Objective A)

Because of the large number of students who participated in the study, it was decided that the best way to assess students' views towards Technical Drawing was to ask them to indicate whether the following subjects: Mathematics, English, Geography, History, Woodwork, Metalwork, Shona, Technical Drawing, French, Physics, and Biology are useful or not by placing them on a scale of 1 to 5. with the degree of usefulness ranging from 1- (very useful) to 5-(useless). This would give an idea of students' perception of Technical Drawing by showing: a) the total number of students who feel that Technical Drawing is a very useful subject and those who feel that it is a useless subject and b) the position of Technical Drawing in relation to the rest of the subjects. (The subjects listed are the common subjects offered in these schools.)
In the following, only alternative 1 (very useful) and alternative 5 (useless) have been considered because they represent definite stand points.

Table 2. School A. Frequencies and percentages of students indicating subjects as useful or useless

	Column 1 (very useful)		Column 5 (useless)	
Subject	Frequency	%	Frequency	%
Mathematics	197	86.8	0	0
English	145	63.9	4	1.8
Geography	83	36.6	10	4.4
History	45	19.8	43	18.9
Woodwork	68	30.0	13	5.7
Shona	47	20.7	33	14.5
Technical drg	116	51.1	8	3.5
French	13	5.7	122	53.7
Physics	97	42.7	9	4.0
Metalwork	89	39.0	9	4.0
Biology	98	43.2	10	4.4
		N=227		

Table 2 shows that out of a total of 227 students, 116 which is 51.1 % think that Technical Drawing is a very useful subject and 8 which is 3.5 % feel that the subject is useless. This places Technical Drawing on third position with Mathematics and English in first and second positions respectively.

In school B the Lower Sixth Form class (Form 5) has not been included because the students only considered the 4 subjects they study at Advanced Level and ignored the rest. They all classified their 4 subjects as very useful. Metalwork has been excluded from the list because the subject has just been introduced and a number of students who participated in the research did not have Metalwork as one of their technical subjects.

Table 3. School B. Frequencies and percentages of students indicating the subjects as useful or useless

	Column 1 (very useful)		Column 5 (useless)	
Subject	Frequency	%	Frequency	%
Mathematics	66	94.3	0	0.0
English	51	72.9	0	0.0
Geography	25	35.7	0	0.0
History	12	17.1	2	2.9
Woodwork	9	12.9	0	0.0
Shona	7	10	8	11.4
Technical drg	30	43.0	2	2.9
French	0	00.0	4	5.7
Physics	20	28.6	0	0.0
Biology	18	25.7	2	2.9

N=70

Table 3 shows that 30 out of 70 students which is 43.0% feel that Technical Drawing is a very useful subject whilst 2 out of 70 students which is 2.9% feel that Technical Drawing is a useless subject. This makes Technical Drawing the third most useful subject. Fewer students consider Technical Drawing as a useful subject compared to school A and also fewer students consider it useless.

Students were required to point out areas of Technical Drawing they dislike most. Quite varied answers were given, but generally they pointed out that they did not dislike any topics at all. Others said engineering drawing or geometry for example without being very specific. The reason given for disliking engineering drawing was that it is difficult and that very often students work on diagrams of unfamiliar objects. Those who dislike geometry gave such reasons as: it is difficult to remember the several constructions they learn, and that they do not see the relevance of some of the constructions. A few of the Form three students singled out auxiliary views and assembly drawing as the topics they dislike most. They all say that they find these topics difficult and confusing. Students singled out specific topics they like best in either engineering or geometrical drawing. Isometric projection was one which featured most. No special reasons were given for liking this topic except that students find it easy. Some students seem to like the difficult topics such as assembly drawing and some difficult geometrical constructions like "Lines In Space." Students pointed out that they like topics which are demanding. They claim that they like topics which make them think. Some students said that Technical Drawing improves

their ability to visualise objects. Those who like geometry give its relevance to mathematics as the reason why they like it. A good number say that they are happy with all areas of Technical Drawing because it is relevant to their future career aspirations which for the majority, are in engineering.

Objective C
On changes to the current Technical Drawing syllabus, a good number expressed satisfaction with the present syllabus. However, many pointed out the need for books, good drawing instruments, and drawing boards.

Almost all students feel that they should be familiar with the objects they draw. Visits to engineering companies would be very useful indeed because they would provide the opportunity for students to see and become familiar with some of these objects.

Objective B
When asked what jobs they would like when they finish their education most students mentioned technical jobs. These were mechanical, civil and electrical engineering, architecture and careers in computer science. The only non-technical professions mentioned were medicine and accountancy. All those who mentioned engineering careers, valued the relevance of Technical Drawing.

Students value Technical Drawing both as a general education subject and as a pre-vocational subject. They hope that Technical Drawing will help them realise their career goals.

3.2.2 Results of the attitude scale

Students who indicated agreement with a positive statement had a score of 4 or 5 depending on the degree of agreement. Students who indicated disagreement with a positive statement had a score of 1 or 2 depending on the degree of disagreement.

Students who indicated disagreement with a negative statement obtained a score of 4 or 5 depending on the degree of disagreement. Students who indicated agreement with a negative statement obtained a score of 1 or 2 depending on the degree of agreement. Finally students who indicated in either case that they were undecided had a score of 3.

Diagrams in the form of bar charts have been used in the presentation of results. Below each figure is a key which shows the 10 items indicated on the diagram as, x1, x2, x3, ...x10. Tables have been used to provide more detailed information. Results are presented in the following order:

1. Results of all items for school A and B.
2. Results of all items for the separate classes.

3.2.2.1 Results of all items for school A and B

School A
The average total score for School A is 37.1 which indicates a positive attitude. In this study a total score of 35 to 50 has been considered as an indication of a positive attitude and a total score of less than 30 as an indication of a negative attitude.

In figure 1 the mean for each item is shown for school A. In this figure it can be seen that items 2, 4, 8 and 9 have the highest average scores
items 5 and 10 have the lowest.

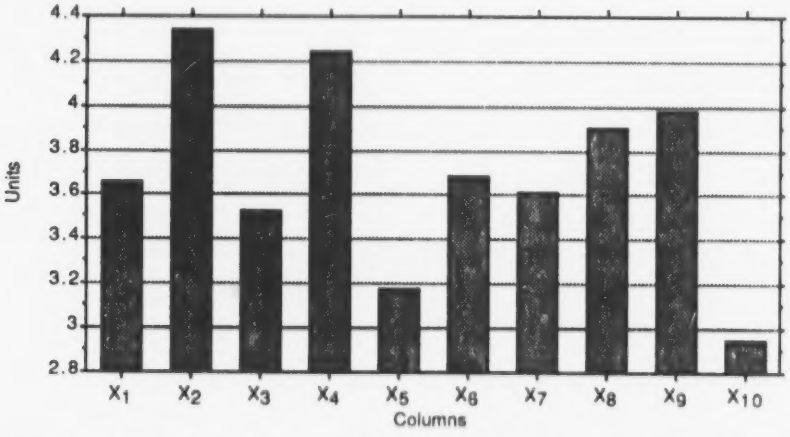

Figure 1. SCHOOL A. The mean for each item of the attitude scale

Key
1. The most useful technical subject in this school is Technical Drawing. (Objective A)
2. If all students had a free choice, nobody would study Technical Drawing because it is a useless subject. (Objective A)
3. Students should spend most of their study time studying English, History, Mathematics, Geography and Science instead of Technical Drawing. (Objective C)
4. Technical Drawing will be very useful to me if I should decide to continue with my studies up to Form four /Advanced level/ University. (Objective B&C)
5. Technical Drawing helps me to understand Mathematics better. (Objective B&C)
6. Everybody should study Technical Drawing, even girls because it is a very useful subject. (Objective B)
7. Technical Drawing is not an interesting subject because it is full of rigid exercises and I'm not free to use my own ideas except to follow rules. (Objective C)

8. I hate Technical Drawing because I spend most of my time drawing diagrams of machine parts which I have never seen. (Objective B)
9. I wish our Technical Drawing course included more graphics topics like electrical drafting, map and computer graphics. (Objective A&C)
10. Most of my friends lose interest in Technical Drawing because there are too many strict rules, especially for beginners. I am expected to be able to draw lines which are perfectly straight and often the lines must be of different densities depending on what they represent. The lettering should be perfect. The letters must be of the same size and must be carefully printed. We are also expected to keep the drawing paper immaculately clean as if it has not been used. I think these rules must be relaxed for beginners. (Objective C).

Table 4. Details of school A attitude scale results

Item	Mean	Std Dev.
1	3.7	1.12
2	4.3	1.10
3	3.5	1.37
4	4.3	0.97
5	3.2	1.28
6	3.7	1.21
7	3.6	1.24
8	3.9	1.01
9	4.0	1.07
10	2.9	1.46

Table 5. SCHOOL -A- Percentages of students who indicated a negative attitude, positive attitude and those who indicated indecision

Item	Negative %	Undecided %	Positive %
1	18.1	17.2	64.8
2	7.9	2.6	89.4
3	25.6	10.0	64.8
4	7.1	7.5	85.5
5	34.8	14.1	51.1
6	22.9	9.7	67.4
7	23.3	10.6	66.1
8	13.7	9.7	76.7
9	11.5	13.5	75.3
10	44.9	9.3	45.8

Item 2 measures the popularity and the acceptance of Technical Drawing as an important and useful subject. Results show that students see Technical Drawing as an important and useful subject . Item 2 has a mean of 4.3 out of a possible mean of 5 and 89.4 % of students in school A indicated a positive attitude as

opposed to 7.9% who indicated a negative attitude. Item 2 has a standard deviation of 1.10 (see Figure 1 and Tables 4 and 5).

Item 4 measures the acceptance or rejection of Technical Drawing as a general education subject useful for further academic and professional studies. It has a mean of 4.3 out of a possible mean of 5 and 85.5% of the students indicated a positive attitude as opposed to 7.1% who indicated a negative attitude. Item 4 has a standard deviation of 0.97. (see Figure 1 and Tables 4 and 5)

Item 8 shows that the majority of students (76.7%) feel that it is not necessary to include practical work in the teaching of Technical Drawing whilst 13.7% think that Technical Drawing should include practical work. Item 8 has a mean of 3.9 and a standard deviation of 1.01. (see Figure 1 and Tables 4 and 5)

Item 9 which measures the acceptance or rejection of the importance of graphics as a means of communication has a mean of 4.0 out of a total of 5. A total of 75.3% indicated a positive attitude as opposed to 11.5% who indicated a negative attitude. Item 9 has a standard deviation of 1.07. (see Figure 1 and Tables 4 and 5).

Items 5 and item 10 have the lowest scores.

Item 5, which measures students' appreciation or lack of appreciation of the relevance of Technical Drawing to Mathematics, has a mean of 3.2 and a standard deviation of 1.28. Only a total of 51.1% indicated a positive attitude and 34.8% indicated a negative attitude.

Item 10 measures students' appreciation or lack of appreciation of some of the teaching methods used in the teaching of Technical Drawing. Item 10 has a mean of 2.9 and a standard deviation of 1.46. A total of 45.8% of students indicated that they do not mind the strict rules they are required to observe. A total of 44.9% feel that these rules should be relaxed.(see Figure 1 and Table 4 and 5) This is the highest percentage of students who indicated a negative attitude towards any of the items on the attitude scale.

Items 2, 4, 8 and 9 have the lowest standard deviations which shows that students' attitudes towards these aspects of Technical Drawing are not very different. Items 5 and 10 which have the lowest mean scores have the highest standard deviations. This shows that students attitudes towards these aspects of Technical Drawing are quite varied.

School B

The total average score for school B is 38 which indicates a positive attitude. This is a little higher than for school A.

In figure 2 the mean for each item is shown for school B. In this figure it can be seen that items 2 and 4, 8 and 9 have the highest scores- as they had in school A too.

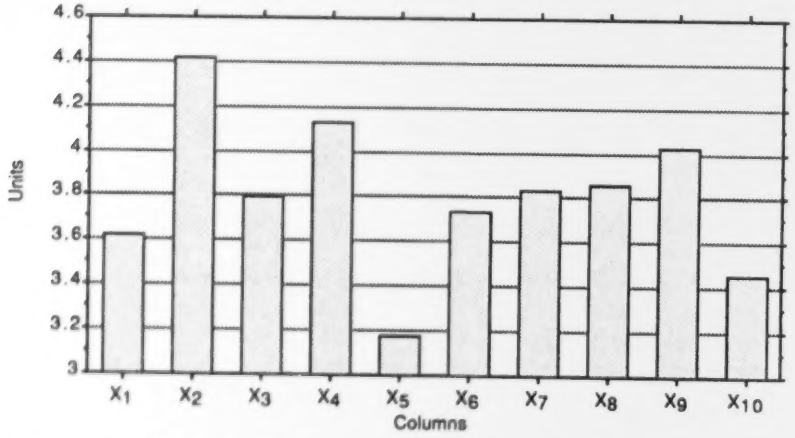

Figure 2. SCHOOL B. The mean for each item of the attitude scale

Key

1. The most useful technical subject in this school is Technical Drawing. (Objective A)
2. If all students had a free choice, nobody would study Technical Drawing because it is a useless subject.(Objective A)
3. Students should spend most of their study time studying English, History, Mathematics, Geography and Science instead of Technical Drawing. (Objective C)
4. Technical Drawing will be very useful to me if I should decide to continue with my studies up to Form four /Advanced level/ University.(Objective B&C)
5. Technical Drawing helps me to understand Mathematics better. (Objective B&C)
6. Everybody should study Technical Drawing, even girls because it is a very useful subject. (Objective B)
7. Technical Drawing is not an interesting subject because it is full of rigid exercises and I'm not free to use my own ideas except to follow rules. (Objective C)
8. I hate Technical Drawing because I spend most of my time drawing diagrams of machine parts which I have never seen. (Objective B)
9. I wish our Technical Drawing course included more graphics topics like electrical drafting, map and computer graphics. (Objective A&C)
10. Most of my friends lose interest in Technical Drawing because there are too many strict rules, especially for beginners. I am expected to be able to draw lines which are perfectly straight and often the lines must be of different densities depending on what they represent. The lettering should be perfect. The letters must be of the same size and must be carefully printed. We are also expected to keep the drawing paper immaculately clean as if it has not been used. I think these rules must be relaxed for beginners. (Objective C).

Table 6. Details of School B attitude results

Item	Mean	Std. Dev.
1	3.6	1.15
2	4.4	0.72
3	3.8	1.08
4	4.1	1.00
5	3.2	1.11
6	3.7	1.02
7	3.8	1.09
8	3.9	1.10
9	4.0	1.09
10	3.5	1.42

Table 7. SCHOOL -B- Percentages of students who indicated a negative attitude, positive attitude and those who indicated indecision

Item	Negative %	Undecided %	Positive %
1	21.4	16.7	61.9
2	1.2	6.0	92.9
3	13.1	16.7	70.2
4	7.1	7.1	85.7
5	28.6	26.2	45.2
6	14.3	21.4	64.3
7	15.5	10.7	73.8
8	15.5	10.7	73.8
9	11.9	17.9	70.2
10	33.3	9.5	57.1

Item 2 has a mean of 4.4 and a total of 92.9% of the students indicated a positive attitude as opposed to 1.2% who indicated a negative attitude. In this case in school B 3.5% more students than in school A indicated a positive attitude. Item 2 has a standard deviation of 0.72 (see Figure 2 and Tables 6 and 7)

Item 4 has a mean of 4.1 and a total of 85.7% of the students indicated a positive attitude as opposed to 7.1 who indicated a negative attitude. Item 4 has a standard deviation of 1.00 (see Figure 2 and Tables 6 and 7)

Item 7 also has a high score. It has a mean of 3.8 and a standard deviation of 1.09. A total of 73.8% of the students indicated a positive attitude as opposed to 15.5% who indicated a negative attitude.(see Figure 2 and Tables 6 and 7)

Items 8 and 9 which have high scores in school A also have high scores in school B but in school A, more students indicated a positive attitude towards these two items. Item 8 has a mean of 3.9 and a standard deviation of 1.10. Item 9 has a mean of 4.0 and a standard deviation of 1.09.

As in school A, items 5 and 10 have the lowest mean scores. Item 5 has a mean of 3.2 and a total of 45.2% indicated a positive attitude as opposed to 28.6% who indicated a negative attitude. Item 10 has a mean of 3.5 and a total of 57.1% indicated a positive attitude as opposed to 33.3% who indicated a negative attitude. Items 5 and 10 have standard deviations of 1.11 and 1.42 respectively (see Figure 2 and Tables 6 and 7).

As in school A items with the highest mean scores have the lowest standard deviations and those with the lowest mean scores have the highest standard deviations.

Results show that students attitudes towards the different aspects of Technical Drawing are basically the same in both schools with small differences as shown in the mean and percentage tables (Tables 4, 5, 6 and 7).

N.B. Because of the effect of rounding off to the nearest tenth of a percentage some of the percentages given in tables 5 and 7 do not add up to exactly 100 percent.

3.2.2.2 Results of all items for the separate classes

To determine whether attitudes are different in the different Forms , a comparison of classes has been made. This has been done by adding the mean scores of all items in each class.

School A had the following results: Form One 36.1 and Form Three 37.9. School B had the following results: Form One 39.9, Form Three 35.8 and Lower Sixth Form 42.9

No definite pattern emerges since the average score for the Form Three class in school A is higher than the average score for the Form One class, and in school B it is completely the opposite with Form One average scores higher than the Form Three average scores. The overall results indicate that attitudes are not different whether one is in a higher or lower Form.

In this case, since there are some differences in the individual items, comparisons of the average scores for each item have been made. Only items with the highest differences have been considered.

School A Form One and Form Three.

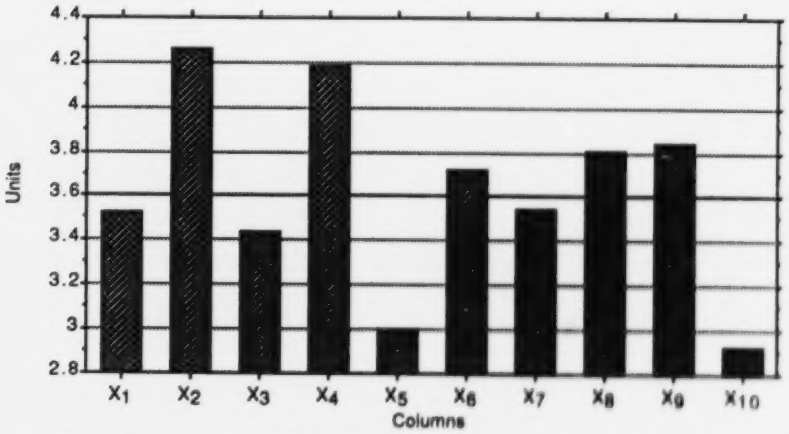

Figure 3. School A. Form One. The mean for each item of the attitude scale

Key

1. The most useful technical subject in this school is Technical Drawing. (Objective A)
2. If all students had a free choice, nobody would study Technical Drawing because it is a useless subject.(Objective A)
3. Students should spend most of their study time studying English, History, Mathematics, Geography and Science instead of Technical Drawing. (Objective C)
4. Technical Drawing will be very useful to me if I should decide to continue with my studies up to Form four /Advanced level/ University.(Objective B&C)
5. Technical Drawing helps me to understand Mathematics better. (Objective B&C)
6. Everybody should study Technical Drawing, even girls because it is a very useful subject. (Objective B)
7. Technical Drawing is not an interesting subject because it is full of rigid exercises and I'm not free to use my own ideas except to follow rules. (Objective C)
8. I hate Technical Drawing because I spend most of my time drawing diagrams of machine parts which I have never seen. (Objective B)
9. I wish our Technical Drawing course included more graphics topics like electrical drafting, map and computer graphics. (Objective A&C)
10. Most of my friends lose interest in Technical Drawing because there are too many strict rules, especially for beginners. I am expected to be able to draw lines which are perfectly straight and often the lines must be of differentdensities depending on what they represent. The lettering should be perfect. The letters must be of the same size and must be carefully printed. We are also expected to keep the drawing paper immaculately clean as if it has not been used. I think these rules must be relaxed for beginners. (Objective C).

Table 8. Details of School A Form One attitude scale results

Item	Mean	Std. Dev.
1	3.5	1.17
2	4.3	1.04
3	3.4	1.44
4	4.2	1.02
5	3.0	1.29
6	3.7	1.18
7	3.5	1.21
8	3.8	1.15
9	3.8	1.15
10	2.9	1.51

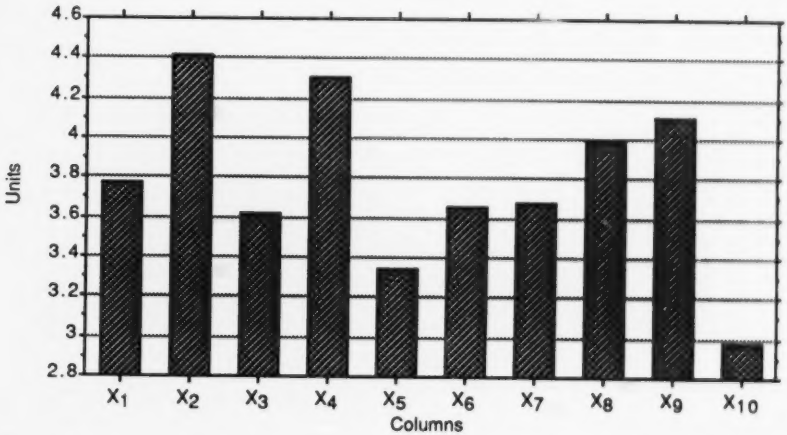

Figure 4. School A Form Three. The mean for each item of the attitude scale

Key

1. The most useful technical subject in this school is Technical Drawing. (Objective A)
2. If all students had a free choice, nobody would study Technical Drawing because it is a useless subject.(Objective A)
3. Students should spend most of their study time studying English, History, Mathematics, Geography and Science instead of Technical Drawing. (Objective C)
4. Technical Drawing will be very useful to me if I should decide to continue with my studies up to Form four /Advanced level/ University.(Objective B&C)
5. Technical Drawing helps me to understand Mathematics better. (Objective B&C)
6. Everybody should study Technical Drawing, even girls because it is a very useful subject. (Objective B)
7. Technical Drawing is not an interesting subject because it is full of rigid exercises and I'm not free to use my own ideas except to follow rules. (Objective C)

8. I hate Technical Drawing because I spend most of my time drawing diagrams of machine parts which I have never seen. (Objective B)
9. I wish our Technical Drawing course included more graphics topics like electrical drafting, map and computer graphics. (Objective A&C)
10. Most of my friends lose interest in Technical Drawing because there are too many strict rules, especially for beginners. I am expected to be able to draw lines which are perfectly straight and often the lines must be of different densities depending on what they represent. The lettering should be perfect. The letters must be of the same size and must be carefully printed. We are also expected to keep the drawing paper immaculately clean as if it has not been used. I think these rules must be relaxed for beginners. (Objective C).

Table 9. Details of School A Form Three attitude scale results

Item	Mean	Std. Dev.
1	3.8	1.07
2	4.4	0.98
3	3.6	1.31
4	4.3	0.93
5	3.3	1.26
6	3.7	1.23
7	3.7	1.27
8	4.0	1.01
9	4.1	0.98
10	3.0	1.42

The bar charts show that the pattern in both classes is almost the same. The differences are in the mean scores. A study of the mean scores indicates that there are very small differences. (see Figures 3 and 4 and Tables 8 and 9) For all items except item 6, the average scores are higher in Form Three than in Form One. The highest differences are in item 1 with a mean score difference of 0.3 and item 5 with a mean score difference of 0.3 and item 9 with a mean difference of 0.3. Item 1 measures acceptance or rejection of Technical Drawing as the most important technical subject considering subjects like Metalwork, Woodwork and Building. Item 5 measures the appreciation or lack of appreciation of the relevance of Technical Drawing to Mathematics. Item 9 measures the acceptance of Graphic Communication as an important means of Communication.

The standard deviation for all items in the Form One class is 1.22 and for the Form Three class is 1.15.

The differences are very small. Attitudes in Form 3 and Form 1 in school A are basically the same.

School B Form One and Form Three.

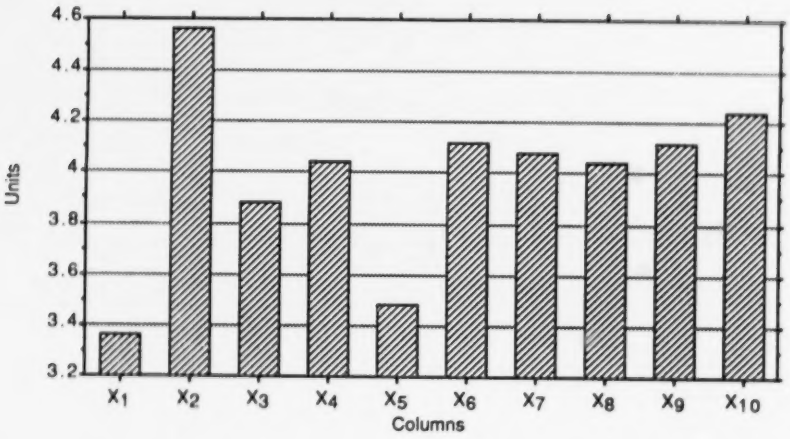

Figure 5. School-B- Form One. The mean for each item of the attitude scale

Key

1. The most useful technical subject in this school is Technical Drawing. (Objective A)
2. If all students had a free choice, nobody would study Technical Drawing because it is a useless subject.(Objective A)
3. Students should spend most of their study time studying English, History, Mathematics, Geography and Science instead of Technical Drawing. (Objective C)
4. Technical Drawing will be very useful to me if I should decide to continue with my studies up to Form four /Advanced level/ University.(Objective B&C)
5. Technical Drawing helps me to understand Mathematics better. (Objective B&C)
6. Everybody should study Technical Drawing, even girls because it is a very useful subject. (Objective B)
7. Technical Drawing is not an interesting subject because it is full of rigid exercises and I'm not free to use my own ideas except to follow rules. (Objective C)
8. I hate Technical Drawing because I spend most of my time drawing diagrams of machine parts which I have never seen. (Objective B)
9. I wish our Technical Drawing course included more graphics topics like electrical drafting, map and computer graphics. (Objective A&C)
10. Most of my friends lose interest in Technical Drawing because there are too many strict rules, especially for beginners. I am expected to be able to draw lines which are perfectly straight and often the lines must be of different densities depending on what they represent. The lettering should be perfect. The letters must be of the same size and must be carefully printed. We are also expected to keep the drawing paper immaculately clean as if it has not been used. I think these rules must be relaxed for beginners. (Objective C).

Table 10. Details of School B Form One attitude scale results

Item	Mean	Std Dev
1	3.4	1.08
2	4.6	0.58
3	3.9	1.01
4	4.0	1.17
5	3.5	0.92
6	4.1	1.09
7	4.1	0.76
8	4.0	0.79
9	4.1	1.09
10	4.2	1.13

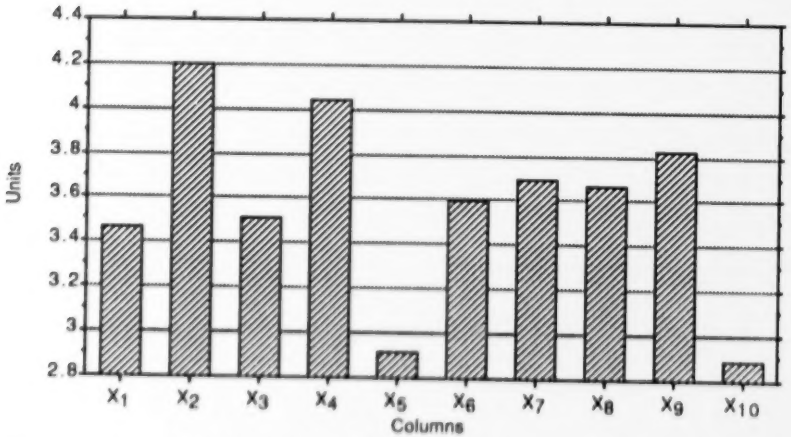

Figure 6. School B. Form Three. The mean for each item of the attitude scale

Key

1. The most useful technical subject in this school is Technical Drawing. (Objective A)
2. If all students had a free choice, nobody would study Technical Drawing because it a useless subject.(Objective A)
3. Students should spend most of their study time studying English, History, Mathematics, Geography and Science instead of Technical Drawing. (Objective C)
4. Technical Drawing will be very useful to me if I should decide to continue with my studies up to Form four /Advanced level/ University. (Objective B&C)
5. Technical Drawing helps me to understand Mathematics better. (Objective B&C)
6. Everybody should study Technical Drawing, even girls because it is a very useful subject. (Objective B)
7. Technical Drawing is not an interesting subject because it is full of rigid exercises and I'm not free to use my own ideas except to follow rules. (Objective C)

8. I hate Technical Drawing because I spend most of my time drawing diagrams of machine parts which I have never seen. (Objective B)
9. I wish our Technical Drawing course included more graphics topics like electrical drafting, map and computer graphics. (Objective A&C)
10. Most of my friends lose interest in Technical Drawing because there are too many strict rules, especially for beginners. I am expected to be able to draw lines which are perfectly straight and often the lines must be of different densities depending on what they represent. The lettering should be perfect. The letters must be of the same size and must be carefully printed. We are also expected to keep the drawing paper immaculately clean as if it has not been used. I think these rules must be relaxed for beginners. (Objective C).

Table 11. Details of school B Form Three attitude scale results

Item	Mean	Std. Dev.
1	3.5	1.16
2	4.2	0.79
3	3.5	1.14
4	4.0	0.98
5	2.9	1.24
6	3.6	0.96
7	3.7	1.20
8	3.7	1.28
9	3.8	1.17
10	2.9	1.40

The Form Three class indicates a less positive attitude than the Form One class. The highest differences are in item 5 with a mean difference of 0.6 and item 10 with a mean difference of 1.3. (see Figures 5 and 6 and tables 10 and 11)

Item 5 measures students appreciation or lack of appreciation of the relevance of Technical Drawing to Mathematics. Item 10 measures students' acceptance or rejection of some of the teaching methods.

The standard deviation for the Form One class for all item is 0.96 and for the Form three class is 1.13

A comparison of the Form One and the Lower Sixth Form mean scores, indicates that for all items with the exception of item 5, 6, 7 and 10 (see Figures 5 and 7 and Table 10 and 12) the Lower Sixth Form class has a slightly more positive attitude than the Form One class. The highest differences are in items 1 (1.2). and item 3 (0.7). (see tables 10 and 12) Item 1 measures students' acceptance of Technical Drawing as a more important subject compared to either Metalwork, Woodwork or Building and item 3 measures students'

acceptance or rejection of Technical Drawing as an intellectually demanding subject.

The standard deviation for all items for the Lower Sixth Form class is .77.

A comparison of the Lower Sixth Form mean scores and the Form Three mean scores shows that the Lower Sixth Form class has a more positive attitude than the Form Three class. The highest differences are in items 1 (1.1) and item 3 (1.1) and item 10 (1.0) (see Figures 6 and 7 and Tables 11 and 12) The aspects of Technical Drawing measured by these items are explained in the previous paragraph.

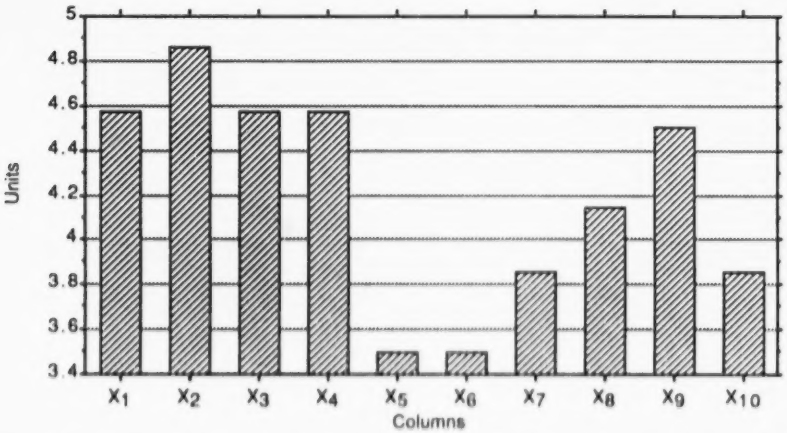

Figure 7. School B. Lower Sixth Form. The mean for each item of the attitude scale

Key

1. The most useful technical subject in this school is Technical Drawing. (Objective A)
2. If all students had a free choice, nobody would study Technical Drawing because it is a useless subject.(Objective A)
3. Students should spend most of their study time studying English, History, Mathematics, Geography and Science instead of Technical Drawing. (Objective C)
4. Technical Drawing will be very useful to me if I should decide to continue with my studies up to Form four /Advanced level/ University.(Objective B&C)
5. Technical Drawing helps me to understand Mathematics better. (Objective B&C)
6. Everybody should study Technical Drawing, even girls because it is a very useful subject. (Objective B)
7. Technical Drawing is not an interesting subject because it is full of rigid exercises and I'm not free to use my own ideas except to follow rules. (Objective C)
8. I hate Technical Drawing because I spend most of my time drawing diagrams of machine parts which I have never seen. (Objective B)
9. I wish our Technical Drawing course included more graphics topics like electrical drafting, map and computer graphics. (Objective A&C)

10. Most of my friends lose interest in Technical Drawing because there are too many strict rules, especially for beginners. I am expected to be able to draw lines which are perfectly straight and often the lines must be of different densities depending on what they represent. The lettering should be perfect. The letters must be of the same size and must be carefully printed. We are also expected to keep the drawing paper immaculately clean as if it has not been used. I think these rules must be relaxed for beginners. (Objective C).

Table 12. Details of School B Lower Sixth Form attitude scale results

Item	Mean	Std. Dev.
1	4.6	0.76
2	4.9	0.36
3	4.6	0.51
4	4.6	0.51
5	3.5	0.86
6	3.5	0.94
7	3.9	1.17
8	4.1	0.86
9	4.5	0.52
10	3.9	1.17

School B Form One results show a fairly strong positive attitude towards most of the items with the exception of item 1.

The Lower Sixth Form bar chart has a different pattern . Items 5 and 6 have the lowest scores. (see figure 7 and table 12) Item 5 as explained above measures students' appreciation of the relevance of Technical Drawing to Mathematics and item 6 measures acceptance of Technical Drawing as a general education subject suitable for all students regardless of gender or career aspirations.

Generally the Lower Sixth Form class shows the strongest positive attitude towards Technical Drawing.

3.3 Conclusion of results

Objective A:
Headmasters and teachers see Technical Drawing as a very important subject hence the subject is either a compulsory subject or is offered to the most able streams. However, the state of the subject is being adversely affected by the following factors:
a) Shortage of teachers especially at 'A' Level.
b) Shortage of books and basic drawing instruments.
c) Inadequate funds to provide modern equipment.

Generally, students' attitudes towards Technical Drawing were found to be positive. Average total score for school A is 37.1 and school B is 38. Students consider Technical Drawing as an important and useful subject which they are willing to have as one of their subjects. This is indicated by the result of item 2 in the attitude scale. A total of 92.9% in school B and 89.4% of the students in school A indicated a positive attitude.

A comparison of the different classes shows that the Lower Sixth Form has the most positive attitude. This is to be expected, because at this level students choose the subjects they want to study.

Objective B
Headmasters and teachers generally feel that Technical Drawing should be offered as a subject in its own right because this makes possible adequate coverage of all important elements. However, there seems to be a strong feeling that the subject should at the same time be closely linked to practical subjects.

Technical Drawing is seen as an essential service subject to the common practical subjects in Zimbabwean schools ie Woodwork, Metalwork and Building. It is also viewed as a subject which helps to clarify some Mathematical concepts.

Teachers and headmasters see Technical Drawing as a subject which prepares students for self-employment and employment in industry. It is also thought to provide the necessary grounding to those intending to proceed to university for the Mechanical Engineering degree.

There is no mention of offering the subject solely for its cognitive values although some of the aims given are cognitive.

Whether a subject should be offered as a general education subject or as a pre-vocational subject is something students can do very little about. Usually their attitude reflects the attitude of headmasters and teachers. The results show that students value Technical Drawing as a general education subject and as a pre-vocational subject. They hope that Technical Drawing will help them realise their career goals, and that Technical Drawing will be useful to them should they decide to continue with their studies. The Item in the attitude scale which measures the acceptance of Technical Drawing as a general education subject indicates a positive attitude in both schools.

Objective C
Generally, teachers seem satisfied with the content of the current syllabus. Minor changes have been suggested but they are not viewed as absolutely

necessary. Most teachers are not familiar with other Graphics syllabuses so they have nothing to compare with. Although teachers give one of the functions of Technical Drawing as preparing students for employment in industry they are not sure whether the content of the syllabuses they use meet the requirements of industry.

With the exception of the provision of books and equipment, teachers did not mention anything else to improve the teaching of the subject.

On the syllabus content, students did not make specific suggestions for improving the subject content. Students singled out topics they liked and topics they disliked. The reasons depend on whether they find the topic easy or difficult. Generally students expressed satisfaction with the current syllabuses although a number of them also feel that the subject should contain other elements of graphics besides geometrical and engineering drawing.
Students feel that the teaching of the subject can be improved by asking students to draw diagrams of objects they are familiar with. This can be made possible by organizing frequent visits to Engineering factories. Visits, according to the students,would also tend to make the subject relevant to industry.

Although the overall results of the study are important, the responses given to each item should be given special attention because they show specific aspects of Technical Drawing which need to be looked into seriously if any amendments are to be made.

4. DISCUSSION

4.1 Summary

The aim of this study was to investigate attitudes towards Technical Drawing and to compare them to the present state of Technical Drawing in the country. A Case Study of two schools in the Harare region was conducted. Information was gathered from students, technical subject teachers and headmasters through questionnaires and interviews.
The objectives of the study were:

a) To find out headmasters', teachers' and students' attitudes towards Technical Drawing and to compare them to the state of Technical Drawing in their respective schools.
b) To find out whether headmasters, teachers and students prefer Technical Drawing as an independent subject with emphasis on the cognitive development of the child or as a pre-vocational subject related to Metalwork, Woodwork and other technical subjects.
c) To establish headmasters', teachers' and students' views on the content of the present 'O' and 'A' level Technical Drawing syllabuses and their suggestions for the improvement of the subject content and teaching.

Literature indicates that attitudes towards a subject seem to be influenced by:

1) Personal development of the student ie cognitive and manipulative skills provided by the subject.
2) Future academic and vocational prospects provided by the subject.
3) Relevance of the syllabus to related situations in the country.
4) Possibilities of immediate application of knowledge acquired in solving everyday problems at school and at home.

These factors formed the basis of this study.

4.1.1 Headmasters' teachers', and students' perception of Technical Drawing (Objective A)

Generally, results indicated that attitudes towards Technical Drawing are positive. The average attitude score in school A is 37.1 and school B 38 out of a possible total score of 50. There seems to be no difference in attitudes towards Technical Drawing between the two schools.

It is fairly clear that attitudes of headmasters and teachers towards Technical Drawing are reflected in the state of the subject in the two schools. In one of the schools Technical Drawing was on the verge of being phased out until when a new headmaster arrived and a very keen teacher was recruited. At the moment

the position of the subject is getting stronger and the number of classes taking Technical Drawing is increasing. The subject is offered to the most able students. In the other school Technical Drawing is a compulsory subject.

The positive attitudes expressed by headmasters and students seem to be dampened by factors which seem to be beyond their control. The shortage of equipment and books can be described as serious. Since books and equipment are essential for the teaching and learning of the subject something needs to be done to provide books and equipment at a reasonable price.

The shortage of teachers is a serious situation. Teachers capable of teaching the subject at 'A' Level are not available.

4.1.2 Technical Drawing as a pre-vocational subject and as a general education subject (Objective B)

On whether Technical Drawing should be seen as a general education subject or as a pre-vocational subject, no definite opinion seems to prevail. Teachers and headmasters have mixed feelings in this respect. Generally they feel that Technical Drawing should be a subject with its own syllabus and examination. At the same time they feel that the subject should have very close links with practical subjects. Teachers and headmasters feel that it should be offered as a subject of study in its own right so that more areas in graphics are covered.

Generally the idea of offering Technical Drawing as a pre-vocational subject seems to find favour with most of the teachers. They feel that Technical Drawing prepares students for further training in either industry or technical colleges and universities. Teachers, headmasters and some students mentioned the importance of the link between Technical Drawing and Mathematics. Ironically, the item in the attitude scale, which was designed to find out whether students feel that Technical Drawing helps them to understand Mathematics better or not had one of the lowest means. This could be the result of lack of communication between Mathematics teachers and Technical Drawing teachers.

Students gave an indication that they value both the educational and vocational aspects of Technical Drawing. The majority of the students hope for careers in Engineering and they believe that Technical drawing will be instrumental in the achievement of their goals. Students claim that Technical Drawing improves their ability to visualise objects. Students who aspire to become doctors or accountants also indicated a positive attitude. It seems students have accepted Technical Drawing both as a general education subject and as a pre-vocational subject. A Form 3 student sums it up by saying:

I would like to be a mechanical or electrical engineer.
I feel that Technical Drawing will help me a great deal.
I can picture many machine components in my mind without
any problems. This enriches my imagination and
actually makes me feel like I'm with the machine
in real life.

The item which measures the acceptance of Technical Drawing as a general education subject suitable for all ie both boys and girls irrespective of future career aspirations, had a mean of 3.7 in both schools out of a possible 5. It seems Technical Drawing as a general education subject which helps in the cognitive development of the child is not receiving as much emphasis as Technical Drawing as a pre-vocational subject. However in an answer to a question which required teachers to give a list of aims for Technical Drawing, teachers listed a number of general education aims.

4.1.3 Syllabus content and teaching method (Objective C)

Both teachers and students expressed satisfaction with the present 'O' and 'A' level Technical Drawing syllabuses. A few teachers pointed out that they are aware of alternative drawing syllabuses but stressed that they would not be willing to change to these 'new' syllabuses. The reason given is that the alternative syllabuses are not as closely related to engineering as the current Technical Drawing syllabuses. A good number of teachers are not aware of other Graphics syllabuses. This could be the reason why most of them are satisfied with the present syllabuses.

Neither teachers nor students suggested many changes to the present syllabuses. However, teachers pointed out that if changes have to be made, then topics like "Lines in space" and Auxiliary views could be removed. The reason given is that these have no immediate application and that students find them difficult. Students did not mention 'Lines in Space' as the most difficult. In fact the majority pointed out that they like difficult topics because they are forced to think.

As a way of improving the teaching of Technical Drawing, students expressed the need for relevance. It seems students are not happy to draw diagrams of unfamiliar objects. Students suggest frequent visits to engineering industries. This means there is need for communication between industry and schools.

Although the results of this study are not representative of the situation in the whole country, they at least give a rough picture of what can be expected in a good number of schools in the same category. Further studies need to be carried out in order to obtain conclusive results. This study has, however, looked at what has hitherto been unexplored. The results have highlighted

areas which although they may not apply to all schools, need some attention from those in authority.

Results of this study should be seen as as a foundation on which future studies will be based.

4.2 Discussion and recommendations

The positive attitude indicated by teachers, headmasters and students are fragile. If the positive attitude is to be maintained and strengthened, immediate measures need to be taken to ease the shortage of books and teachers. Books are not available because schools rely on imported books. This will remain a major problem unless Zimbabweans themselves start writing books. Providing millions of dollars for the importation of books, only provides a temporary relief.

It is surprising to still find an absence of properly qualified 'O' Level Technical Drawing teachers. One cannot help wondering what happens to the newly-trained teachers coming out of the teacher's college. The deployment policy of newly qualified teachers surely needs to be reconsidered. Relying on student teachers is not the answer to the problem of the shortage of teachers. In most cases the student teachers have no-one to supervise them since schools do not usually have a qualified teacher for the subject. The student suffers, and it can be assumed that this will have a negative effect on students' and teachers' attitude towards the subject. Teachers' colleges train teachers who teach up to 'O' Level. It is the responsibility of the university to provide the desperately needed 'A' Level teachers. To meet the demand, the university will have to increase its enrolment of the Bachelor of Education degree students.

Students complained of the poor state of their drawing equipment. Drawing equipment needs to be renewed from time to time. If the government allocation for technical subjects is shared proportionately (considering consumable materials required for the subject) perhaps it is time the allocation for Technical Drawing to be reassessed. Headmasters and heads of departments need to be sensitive to this need. If the subject is to be taught as a pre-vocational subject, then schools should not only make an effort to renew the equipment but should also see to it that out- dated equipment is replaced.

Technical Drawing in Zimbabwean schools is taught mainly for its vocational aspects. Teachers and headmasters feel that this is the best way if it is to benefit the country. While this is true , it should also be noted that a country can ill afford to sacrifice its people for technological development. Technical Drawing would probably be more useful if the cognitive aspect of the subject is also taken into account. It should be realised that the ability to calculate, prepare

correct diagrams, and to make an object produces a 'technologically advanced person' but not necessarily an 'educated' person. The educational ie the cognitive and the technological aspects of a subject should be given equal emphasis.

If the subject is to help technological development, then educationists in the country should consider shifting emphasis from the craft-based Technical Drawing to Technical Drawing based on engineering and modern technology. Subjects like Elements of Engineering Design or Applied Mechanics should be taught in conjunction with Technical Drawing especially at high levels. For these reasons Zimbabwe should take a definite stand on the question of offering Technical Drawing as a general education subject or as a vocationally oriented subject. An attractive proposition for Zimbabwe is probably to offer the subject as a general education subject in the early years of secondary school, in the form of Technical Graphics (Graphic Communication). Later on, students can specialise either in engineering or architectural drawing. This will make it possible for students to obtain a broad knowledge of general graphics before specialising in specific areas. This will also enable students to benefit from both the cognitive and vocational aspects of the subject.

At higher levels Technical Drawing should be offered as a vocationally oriented subject. This means that although the subject is offered as an area of study in its own right, it is linked to particular branches of engineering. At this level schools should have close contacts with industry and also the university. Teachers and headmasters pointed out that one of the reasons schools offer 'A' Level Technical Drawing is because they believe that Technical Drawing prepares students for further training in industry and technical colleges. Knowledge of the subject is also seen as necessary for the Mechanical Engineering degree at the university. Contacts should therefore exist between the university and schools. However, teachers are not even sure whether the university accepts Technical Drawing as one of the subjects for entry into the faculty of engineering. (In the United Kingdom, Engineering Drawing used to be considered as a third subject after Mathematics and Physics for those wishing to study engineering)

If the subject is taught as a pre-vocational subject preparing students for industry, the syllabus should be up-dated to keep up with developments in industry. If teachers and headmasters have a positive attitude towards Technical Drawing then surely they want to see the subject develop. It is worrying to realise that some teachers are not aware of the existence of other Graphics syllabuses and that those who are would rather keep to the current syllabuses. Zimbabweans cannot afford to ignore changes, though this of course does not mean that the country has to accept or duplicate what is happening in other countries lock, stock and barrel. Developments elsewhere can be used as guide-

lines for the development of a Zimbabwean Graphics syllabus. Cummings (1985) argues that one of the reasons why Technical subjects in schools are not considered by industrialists as suitable preparation for industrial employment is because the skills taught in schools are out of date. Schools cannot keep abreast of technological changes. If the subject is offered as a pre-vocational subject then formalised links with industry will guarantee relevance of the subject.

The inclusion of design drawing should be considered seriously. While Technical Drawing deals with the acquisition and application of established graphical facts and techniques design drawing stimulates creativity in students.

Changes in the syllabus also affect teaching methods. Teachers need to be exposed to what is happening in other parts of the world so that they are in a better position to evaluate their teaching methods and the syllabuses they use. Workshops and seminars need to be organised to familiarise teachers with the latest developments. Teachers need to reconsider some of the teaching methods they use. Relaxation of rules, giving students an opportunity to apply the knowledge acquired and also permitting them to incorporate their own ideas are methods which have captured students' teachers' and headmasters' approval in other countries.

Students feel that visits to industries should be arranged so that they familiarise themselves with some of the objects they draw. It should be noted however, that working on diagrams of unfamiliar objects can also improve one's ability to imagine and visualise objects instead of relying on recall.

Students indicated that they are interested in pursuing careers in engineering or architecture and they hope that Technical Drawing will play a part in their achievement of these expectations. The schools unfortunately do not give the student an option to choose between engineering and architecture. Schools in rural areas tend to offer building drawing whilst those in urban areas offer engineering drawing. It would suit students' aspirations better if schools offered both, thus giving the student the option to choose.

4.2.1 Future studies

This study provided a picture of what may be expected in one group of schools- the Group A schools (Former white only government schools) Similar studies need to be carried out in other types of schools ie Group B schools (Former black only government schools) rural and private schools. Since Group B and rural schools are generally not as well equipped as Group A schools and since private schools generally have sufficient funds to provide adequate and modern equipment and facilities, attitudes towards the subject may be different.

Before studies are conducted in these other types of schools another study needs to be carried out in the Group A schools to include Forms 2, 4 and Upper Sixth Forms. An inclusion of all classes will give a better picture of students' attitudes than this study which only managed to include Forms 1, 3 and one Lower Sixth Form. If all classes are to be included, then studies need to be conducted at the beginning or middle of the year before examinations start. Examination periods should be avoided because then a researcher is more of an intruder than someone trying to improve the situation for the benefit of all involved.

After the case studies a larger scale study could be carried out throughout the country in order to make some definite conclusions and recommendations which are applicable to all schools in the country. A large scale study should also seek the views of industrialists and institutions of higher education. It is important that the large scale study is preceded by case studies of the different groups of schools so that specific aspects of Technical Drawing which are normally affected by attitudes are identified.

A study of attitude is a way of seeking guidance from people involved in a subject. If education in Zimbabwe is to satisfy peoples' needs and expectations, extensive studies need to be conducted. Impromptu decisions leading to changes of syllabuses because countries feel that they are lagging behind other countries could be avoided when more knowledge concerning the different subjects is accumulated.

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Definition of terms

Technical Drawing: A broad term for any drawing which expresses technical ideas, including sketches, instruments drawings, charts and illustrations.

Plane Geometry: Two Dimensional Geometry.

Solid or Descriptive Geometry: Three dimensional geometry.

Engineering Drawing: Drawing used by Engineers and others to describe the production of a part, the shape, the size and materials.

Technical Graphics/ Graphic Communication: A broad Drawing course including: plane geometry, solid geometry, technical illustration, building drawing, computer graphics, electrical graphics etc.This is a course which was introduced in order to bridge the gap between Engineering Drawing and Art. Design Drawing includes knowledge of Art and Engineering Drawing.

Technical Sketching: Free- hand technical drawing.

Pre-vocational: The term pre-vocational refers to experiences which enable the student to make better career choices or decisions associated with the transition into the work force. Pre-vocational is not a formal training programme designed to allow someone to take up employment but pre-vocational subjects stress the acquisition of knowledge and skills relevant to industry without extensive specialisation.

General education subject: This term has been used to refer to Technical Drawing taught as an independent subject, with more emphasis on its general educational values than on its vocational values.

Academic relevance: As used in this study this term refers to the link between Technical Drawing and academic subjects eg mathematics, geography, science etc.

Student: The word student has been used in this study in place of pupil.

Appendix II a

Rydsvägen 248 : C34
S 582-48 Linköping
Sweden
1 August 1988.

The Secretary
University of Cambridge
Local Examination Syndicate
Syndicate Buildings
1 Hills Road
Cambridge C B 1 2E U.

Dear Sir/ Madam,

Iam a Zimbabwean Technical Graphics student studying for a Masters Degree at Linköping University in Sweden. I will soon be writing a dissertation on "Technical Drawing in Zimbabwe." The study will concern the development of Technical Drawing, its aims, its position in the schools' curricula, people's attitude and its possible future trends. Part of my research includes a study of the development of the subject in other countries. I have chosen the United Kingdom as one of these countries because of its past and present influences on Zimbabwean education.

I would be grateful if you could help me with a list of documents (including prices) related to the development of Technical Drawing or Graphic Communication (Technical Graphics) Iam also interested in documents which show changes that have taken place in the teaching of the subject in the United Kingdom.

I would also be grateful if you could kindly complete the enclosed

questionnaire or pass it on to somebody else for completion.

Please Note : The title Technical Drawing as used in the questionnaire stands for. Geometrical and Mechanical Drawing or Geometrical and Engineering Drawing or Geometrical and Building Drawing.

Please write your answers on separate papers.

Thanking you in advance.

Yours Sincerely

George Chinzvimbo.

QUESTIONS

1.How did Technical Drawing develop from being a supportive subject to a full subject?

2. What are the present vocational aims of Technical Drawing?

3. In what ways, besides providing knowledge and skills does Technical Drawing contribute to the pupils' personal development?

4. What is the status of Technical Drawing today in the United Kingdom?

5. Has the introduction of Craft Design and Technology had any effect on Technical Drawing?
Please state your argument.

6. In your opinion should students of Technical Drawing also study subjects like Metalwork, Woodwork, Elements of Engineering Design etc?
Please state your argument.

7. In the United Kingdom, is the number of schools offering Technical Drawing increasing or decreasing?

8 a) Technical Graphics (Graphic Communication) was introduced long after Technical Drawing. Why was it seen necessary to introduce this subject?

b) Why is Technical Graphics offered as an area of study in its own right and not as a supportive subject?

9. What are the present vocational aims of Technical Graphics?

10. In what ways besides providing knowledge and skills does Technical Graphics contribute to the pupils' personal development?

11. In the United Kingdom is the number of schools offering Technical Graphics increasing or decreasing?

12. You administer 'O' and 'A' level examinations in a lot of overseas English speaking countries. Is Technical Drawing and /or Technical Graphics popular in these countries? What do you think are the reasons for its popularity or lack of popularity?

13. How does 'A' Level Technical Drawing help a student in his/ her future career , vocational or academic?

THANK YOU

Appendix IIb

Rydsvägen 248 : C34
S 582-48 Linköping
Sweden
1 August 1988.

The Secretary
The Scottish Examination Board.
Ironmills Road
Dalkeith
Midlothian EH 22 1LE

Dear Sir/ Madam,

I am a Zimbabwean Technical Graphics student studying for a Masters Degree at Linköping University in Sweden. I will soon be writing a dissertation on "Technical Drawing in Zimbabwe." The study will concern the development of Technical Drawing, its aims, its position in the schools' curricula, people's attitude and its possible future trends. Part of my research includes a study of the development of the subject in other countries. I have chosen the United Kingdom as one of these countries because of its past and present influences on Zimbabwean education.

I would be grateful if you could help me with a list of documents (including prices) related to the development of Technical Drawing or Graphic Communication (Technical Graphics) I am also interested in documents which show changes that have taken place in the teaching of the subject in Scotland.

I would also be grateful if you could kindly complete the enclosed

questionnaire or pass it on to somebody else for completion.

Please Note : The title Technical Drawing as used in the questionnaire stands for: Geometrical and Mechanical Drawing or Geometrical and Engineering Drawing or Geometrical and Building Drawing.

Please write your answers on separate papers.
Thanking you in advance.

Yours Sincerely

George Chinzvimbo.

QUESTIONS

1.How did Technical Drawing develop from being a supportive subject to a full subject?

2. What are the present vocational aims of Technical Drawing?

3. In what ways, besides providing knowledge and skills does Technical Drawing contribute to the pupils' personal development?

4. What is the status of Technical Drawing today in Scotland?

5. In your opinion should students of Technical Drawing also study subjects like Metalwork, Woodwork, Elements of Engineering Design etc? Please state your argument.

6. Will the introduction of Technological studies have any influence on Technical Drawing?

7. In Scotland, is the number of schools offering Technical Drawing increasing or decreasing?

8. What areas of Tehnical Drawing, if any, do you see as in need of improvement?

9. Do you also offer Technical Graphics (Graphic Communication)?

10. If your answer to question 9 is negative, give reasons why you never considered offering Technical Graphics?

11. If your answer to question 9 is positive, how does Technical Graphics compare to Technical Drawing?

Please, state the major differences and any reasons that account for these differences?

12. What are the vocational aims of a Technical Drawing?

13. In what ways besides providing knowledge and skills does Technical Graphics contribute to the pupils' personal develpment?

14. In Scotland is the number of schools offering Technical Graphics increasing? Please give resons.

15. With the use of computers in drawing how do you see the future of Technical Drawing or Graphic Communication?

16. 13. How does 'A' Level Technical Drawing help a student in his/ her future career , vocational or academic?

THANK YOU.

Appendix IIc

Rydsvägen 248: C34
S 582-48 Linköping
Sweden
30 August 1988.

The Secretary
The Business and Technical
Education Council
Central House
Upper Woburn
London W C 1 H

Dear Sir/ Madam,

I am a Zimbabwean Technical Graphics student studying for a Masters Degree at Linköping University in Sweden. I will soon be writing a dissertation on "Technical Drawing in Zimbabwe." The study will concern the development of Technical Drawing, its aims, its position in the schools' curricula, people's attitude and its possible future trends. Part of my research includes a study of the development of the subject in other countries. I have chosen the United Kingdom as one of these countries because of its past and present influences on Zimbabwean education. I have been advised to write to you by the British Council in Stockholm, Sweden.

I would be grateful if you could help me with a list of documents (including prices) related to the development of Technical Drawing or Graphic Communication (Technical Graphics) I am also interested in

documents which show changes that have taken place in the teaching of the subject in the United Kingdom.

I would also be grateful if you could kindly complete the enclosed questionnaire or pass it on to somebody else for completion.

Please Note : The title Technical Drawing as used in the questionnaire stands for. Geometrical and Mechanical Drawing or Geometrical and Engineering Drawing or Geometrical and Building Drawing.

Please write your answers on separate papers.

Thanking you in advance.

Yours Sincerely

George Chinzvimbo.

QUESTIONS

1. What is the status of Technical Drawing today in the BTEC programme ?

b. Did the introduction of CDT. (Craft Design and Technology) have any effect on Technical Drawing.?

2. What are the vocational aims of Technical Drawing ?

3. Do you think Technical Drawing should stand as an area of study in its own right?

4. In your opinion should students of Technical Drawing also study subjects like Metalwork, Woodwork, Elements of Engineering Design etc? Please state your argument.

5. In what ways besides providing knowledge and skills does Technical Drawing contribute to the pupils' personal development?

6. How does the teaching of the subject change as the student progresses? For instance, is there any specialisation at higher levels?

7. What is the propotion of boys and girls taking Technical Drawing?

8. What areas of Technical Drawing, if any, do you see as in need of improvement?

9. With the use of computers in drawing how do you see the future of Technical Drawing or Graphic Communication?

10. What other forms of Graphics courses do you offer and what are their vocational values?

11. Are the Graphics courses you offer more popular than Technical Drawing?
Please give reasons?

12. What areas of advancement are open to students who are exceptionally good in Technical Drawing or any other Graphics course you offer?

THANK YOU.

Appendix IIIa

Technical Drawing in Secondary Schools.

QUESTIONNAIRE (STUDENTS)

NAME: _____

CLASS: _____

AGE: _____

MALE /FEMALE: _____

READ EACH ITEM CAREFULLY AND UNDERLINE QUICKLY THE PHRASE WHICH BEST EXPRESSES YOUR FEELING ABOUT THE STATEMENT. WHEREVER POSSIBLE LET YOUR OWN PERSONAL EXPERIENCE DETERMINE YOUR ANSWER. DO NOT SPEND MUCH TIME ON ANY ITEM IF IN DOUBT, UNDERLINE THE PHRASE WHICH SEEMS MOST NEARLY TO EXPRESS YOUR PRESENT FEELING ABOUT THE STATEMENT.

1) The most useful Technical subject in this school is Technical Drawing.

Strongly Agree / Agree / Undecided /Disagree /Strongly Disagree.

2) Students like Technical Drawing, only because it is a soft option.

Strongly Agree /Agree / Undecided / Disagree /Strongly Disagree

3) If all students had a free choice, nobody would study Technical Drawing because its a useless subject.

Strongly Agree / Agree /Undecided / Disagree / Strongly Disagree.

4) For complete communication in this modern world, one should be able to communicate literary, numerically and graphically.

Strongly Agree /Agree / Undecided / Disagree / Strongly Disagree.

5) With Technical Drawing knowledge and skills I will be able to earn a living even if I fail to get employment in an established company.

Strongly Agree /Agree / Undecided / Disagree / Strongly Disagree.

6) Students should spend most of their study time studying English, History, Mathematics,Geography etc. and not Technical Drawing.

Strongly Agree /Agree / Undecided /Disagree / Strongly Disagree.

7) Technical Drawing will be very useful to me if I should decide to continue with my studies up to Form 4 / Advanced Level / University.

Strongly Agree / Agree / Undecided / Disagree / Strongly Disagree.

8) Studying Technical Drawing alone without studying Metalwork, Woodwork or Building is useless because one is not able to use the diagrams and also one does not understand what is represented by the diagrams.

Strongly Agree / Agree /Undecided /Disagree / Strongly Disagree.

9) Technical Drawing helps me to understand mathematics better.

Strongly Agree / Agree / Undecided / Disagree / Strongly Disagree.

10) I like Technical Drawing but I wish it was as productive as Metalwork and Woodwork, so that I can always take something home to show my parents. I can't take the diagrams only because my parents don't understand them. They like real objects.

Strongly Agree / Agree / Undecided / Disagree / Strongly Disagree.

11) Everybody should study Technical Drawing, even girls, because it is a

very usefull subject

Strongly Agree / Agree /Undecided / Disagree /Strongly Disagree.

12) Technical Drawing is only useful to those who wish to become engineers but not to those who wish to become doctors or teachers of mathematics, history and geography.

Strongly Agree /Agree / Undecided / Disagree / Strongly Disagree.

13) I have on a number of occasions made use of my Technical Drawing knowledge and skills to solve problems at home and in other subjects at school.

Strongly Agree / Agree / Undecided / Disagree / Strongly Disagree.

14) Technical Drawing is not an interesting subject because it is full of rigid exercises and I am not free to use my own ideas except to follow rules.

Strongly Agree / Agree / Undecided / Disagree / Strongly Disagree.

15) I hate Technical Drawing because I spend most of my time drawing diagrams of machine parts which I have never seen.

Strongly Agree /Agree / Undecided / Disagree / Strongly Disagree

16) I understand my mathematics better if I can solve the problems both algebraically and graphically.

Strongly Agree / Agree / Undecided / Disagree / Strongly Disagree.

17) Solving problems graphically is so important that I wish our Technical Drawing course included more graphics topics like electrical drafting and computer graphics and map drafting.

Strongly Agree / Agree /Undecided / Disagree / Strongly Disagree.

18) At the end of a number drawing exercises teachers should give us an opportunity to design our own objects using the acquired knowledge and skills.

Strongly Agree / Agree / Undecided / Disagree /Strongly Disagree.

19) Most of my friends lose interest in Technical Drawing because there are too many strict rules, especially for beginners.I am expected to be able to draw lines which are perfectly straight and often the lines must be of different densities depending on what they represent. The lettering also should be perfect.The letters must be of the same size and must be carefully printed We are also expected to keep the drawing paper immaculately clean as if it has not been used. I think these rules must be relaxed for beginners.

Strongly Agree / Agree / Undecided / Disagree / Strongly Disagree.

20) I think Technical Drawing should be for students who are academically weak.

Strongly Agree /Agree /Undecided / Disagree / Strongly Disagree

21) Indicate below whether you think a subject is useful or not. The degree of usefulness ranges from 1-(very useful) to 5 -(useless)

	1	2	3	4	5
Mathematics					
English					
Geography					
History					
Woodwork					
Stone					
Technical Drawing					
French					
Physics					
Metalwork					
Biology					

22) What areas of Technical Drawing do you hate most and why?

23) What areas of Technical Drawing do you like best and why?

24) What changes would you like to see in your Technical Drawing course and also what do you think your teacher should do to make the subject more interesting?

25) What kind of job would you like to have when you leave school/ college /university?

THANK YOU.

Students questions and explanations:

1) **The most useful technical subject in this school is Technical Drawing.**
This statement was designed to find out whether students considered Technical Drawing a useful subject especially when compared to subjects like Metalwork, Woodwork and Building which are generally seen as productive subjects.This statement was also meant to determine whether students value their technical subjects in terms of 'physical' production or whether they value the knowledge gained even if no tangible product is produced.

2) **Students like Technical Drawing only because it is a soft option.**
This was to find out whether students accept Technical Drawing as an intellectually demanding subject and that they do not see Technical Drawing as a subject to improve their chances of getting the usually required '5 'O' levels' or the required number of Advanced Level subjects for university entrance.

3) **If all students had a free choice, nobody would study Technical Drawing because it is a useless subject.**
This was designed to determine whether students study Technical Drawing willingly or because they are required to.

4) **For complete communication in this modern world, one should be able to communicate literary, numerically and graphically.**
This was to find out whether students see Technical Drawing as a specialist subject or a subject which is necessary to everyone regardless of career aspirations.

5) **With Technical Drawing knowledge and skills, I will be able to earn a living even if I fail to get employment in an established company.**
This was to determine whether students see Technical Drawing not only as a general education subject but also as a subject which provides students with survival skills and knowledge.

6) **Students should spend most of their study time studying English, History, Mathematics,Geography and Science instead of Technical Drawing.**
This statement was designed to find out two things: a) How students rate Technical Drawing in comparison with academic subjects. b) Whether students feel that Technical Drawing is so intellectually demanding that it needs time for private study.

7) **Technical Drawing will be very useful to me if I should decide to continue with my studies up to Form 4 /Advanced Level/ University.**
This statement was designed to find out whether students see Technical Drawing as a subject with some useful future academic relevance. In

other words this was to determine whether students view Technical Drawing as a subject which leads somewhere and not as a dead end subject.

8) **Studying Technical Drawing alone without studying it together with Metalwork, Woodwork or Building is useless because one is not able to use the diagrams and also one does not understand what is represented by the diagram.**
This was to determine whether students accept that Technical Drawing can be studied as an independent subject or whether they feel that it should be part of Metalwork, Woodwork etc.

9) **Technical Drawing helps me to understand Mathematics better.**
This was to find out if students are aware of the link between Technical Drawing and other subjects. It is important that students are not only aware of the link but that they apply their knowledge of Technical Drawing to other areas.This statement was also intended to assess the teaching of the subject ie whether teachers of Technical Drawing relate their subject to other subjects.The same applies to the teachers of Mathematics because very often Mathematical concepts which seem abstract are clearly explained visually by graphic means.

10) **I like Technical Drawing but I wish it was as productive as Metalwork and Woodwork so that I can always take something home to show my parents. I cannot take the diagrams only because my parents do not understand them.They like real objects.**
This statement was designed to determine whether students appreciate both practical and theoretical technical knowledge. There has been a lot said about 'education with production.' in Zimbabwean schools. This statement was designed to find out how the idea of 'education with production' has influenced students' attitudes because the 'production' has in most cases been interpreted as the production of tangible products.

11) **Everybody should study Technical Drawing, even girls because it is a very useful subject.**
This statement was aimed at finding out whether students accept Technical Drawing as a general education subject which is for the general development of the human being regardless of future career aspirations.

12) **Technical Drawing is only useful to those who wish to become engineers but not those who wish to become doctors, or teachers of Mathematics, History and Geography.**
Like statement number 11, this statement was intended to find out whether students accept that Technical Drawing is a general education subject which should be studied by everybody regardless of career interests.

13) **I have on a number of occasions made use of my Technical Drawing knowledge and skills to solve problems at home and in other subjects at school.**
This was to find out whether students see Technical Drawing concepts as abstract, concepts with no practical application or whether students see the relevance of Technical Drawing in other subjects eg Mathematics, Geography, Science, Metalwork, Woodwork, Building etc. This statement was also meant to evaluate the approach followed in the teaching of Technical Drawing. Are teachers using the traditional methods of Teaching Drawing skills only without giving pupils the opportunity to apply the knowledge acquired and at the same time incorporate their own ideas.

14) **Technical Drawing is not an interesting subject because it is full of rigid exercises and I am not free to use my own ideas except to follow rules.**
This was generally meant to assess pupils' feelings towards the methods of teaching Technical Drawing which are generally used in Zimbabwean schools ie the teaching of drawing skills and geometrical constructions, with a strict adherence to drafting rules. Generally students learn these drawing skills and the different geometrical constructions very well but a good number are not aware of the practical application of what they learn.

15) **I hate Technical Drawing because I spend most of my time drawing diagrams of machine parts which I have never seen.**
This was designed to find out whether students feel that Technical Drawing should always have strong links with practical subjects and not taught in isolation.

16) **I understand my Mathematics better if can solve the problems both graphically and algebraically.**
For every Mathematical procedure or method, there is a graphic counterpart. Are students aware of this? Do Technical Drawing and Mathematics teachers take advantage of this situation? Do students value graphical solutions to mathematical problems or do they view graphical methods as specially for those who are not very bright? Statement number 16 sought answers to these questions.

17) **I wish our Technical Drawing course included more graphics topics like: electrical drafting, map and computer graphics.**
This statement aimed at finding out whether students see the presentation of information and details of a component graphically as useful.

18) **At the end of a number of drawing exercises, teachers should give us an opportunity to design our own objects using the acquired knowledge and skills.**

This statement like number 14 was designed to give students an opportunity to evaluate the approach followed in the teaching of the subject. It was to determine whether students prefer a more liberal approach to the teaching of the subject as opposed to the traditional approach which does not give students the opportunity to apply the knowledge acquired to solve everyday problems.

19) **Most of my friends lose interest in Technical Drawing because there are too many strict rules, especially for beginners. Iam expected to be able to draw lines which are perfectly straight and often the lines must be of different densities depending on what they represent. The lettering should be perfect. The letters must be of the same size and must be carefully printed. We are also expected to keep the drawing paper immaculately clean as if it has not been used. I think these rules must be relaxed for beginners.**

This was to determine the effect of the 'well known' strict rules, associated with Technical Drawing on attitudes towards the subject. Like number 19 and 14 it was to assess the influence of the teaching approach on attitudes.

20) **I think Technical Drawing should be for students who are academically weak.**

This statement was to determine whether students' attitudes towards Technical Drawing are affected by the common belief in a lot of Zimbabwean schools where students are streamed and poor students are channeled into the technical stream whilst the A stream students study the traditionally prestigious subjects like Mathematics and Science.

Q. 21. Indicate below whether you think a subject is useful or not. The degree of usefulness ranges from 1- very useful to 5 useless.

Subject	1	2	3	4	5
Mathematics					
English					
Geography					
History					
Woodwork					
Shona					
Technical drawing					
French					
Physics					
Metalwork					
Biology					

(Objective A&C)

The reason for the inclusion of this question was to find out how students would rate Technical Drawing in relation to the other subjects offered in schools.(Objective C)

Q. 22. What areas of Technical Drawing do you dislike most and why? (Objective C)

Q.23. What areas of Technical Drawing do you like best and why? (Objective C)

Q.24. What changes would you like to see in your Technical Drawing course and also what do you think your teacher should do to make the subject more interesting? (Objective C)
These three questions were designed to find out students' suggestions and views towards the current syllabuses used in Zimbabwean schools and the teaching methods.

Q.25. What kind of job would you like to have when you leave school/ college/ university? (Objective B&C)
The aim of this question was to find out whether there is any link between Technical Drawing and the students' career aspirations.

TECHNICAL DRAWING IN SECONDARY SCHOOLS

QUESTIONNAIRE (TEACHERS AND HEADMASTERS)

NAME: _____

MALE / FEMALE: _____

TEACHING
QUALIFICATION (S): _____

EXPERIENCE AS A TEACHER: _____

SUBJECTS QUALIFIED TO TEACH: _____

PRESENT SUBJECT AREA/AREAS *AND* PERIOD OF EXPERIENCE IN EACH AREA: _____

1) This school has offered Technical Drawing for many years. Are you offering this subject today because its a subject which has always been in existence in this school or is it because you see the value of the subject?_____

b) How do you think the subject benefits the student both academically and vocationally?

2) Do you see Technical subjects as for preparing students for employment or as general education subjects?_____

Please give reasons _____

3) Do you think Technical Drawing should stand as an area of study in its own right and not as part of either Metalwork or Woodwork?_____

Please give reasons

4) I understand you have started offering "A" level Technical Drawing. Who initated this and what are the main reasons?

b) How does " A"level Technical Drawing help students?

5) Do you have streaming in this school?

b) If yes which classes take Technical Drawing?

c) Are there any subjects which may be taken by students in other streams, but not by the stream that takes Technical drawing?

d) If the answer is yes please list the subjects below

a)_____ b) _____
c)_____ d)_____
e)_____ f)_____
g)_____ h)_____
i)_____ j)_____

e) Does this streaming discourage brighter students from taking Technical Drawing _____

_____

_____

_____

_____

6) For which of the two groups of students do you personally think Technical Drawing is best suited The academically above average or below average student?_____

_____

_____

_____

_____

b) Please give reasons

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

8) If the ministry of education made Technical Drawing a compulsory subject for all secondary school students, woud you view this as an acceptable action to take?_____

_____

_____

b) Please give reasons for your answer _____

9) Are you aware of other types of Drawing courses offered by your present examining board? _____

b) Would you change for these if you were given the option? _____

Please give reasons _____

10) Generally headmasters and teachers use the technical subjects in their schools to show that they are involved in education with production. Do you see Technical Drawing as a productive subject? If so what do your Technical Drawing students do for their education with production?

11) Do you give your pupils an opportunity to apply their knowledge of Technical Drawing to solve other related everyday problems?

b) Please give examples

12) Can you say Technical Drawing is popular among your students?
Please give reasons for your answer.

13a) What is the pass rate in this subject?

b) What do you think are the contributing factors?

14) Are there any problems you have with Technical Drawing eg shortage of qualified teachers,equipment and books etc.

15) You get an allocation from government for Technical subjects. Is this money distributed equally?

b) What percentage does Technical Drawing as a subject get

Do you have adquate facilities and equipment for Technical Drawing?

16) The University of Cambridge "O" level Technical Drawing syllabus does not include aims and objectives. What are your aims and objectives at "O"level

17) Which "O" level Technical Drawing topics do you think are the least important and which topics do you think are the most important? Please include reasons.

18) Are you aware of the demands of industry in the area of Technical Drawing? _____

b) If yes please give examples. _____

c) Do you have contacts with particular industries?

d) If yes do you accommodate their demands or you limit your teaching to the requirements of the syllabus only?_____

19) Do you have additions or alterations you would want to see made to the present "O" level Technical Drawing Syllabus?

Please list them down and also give reasons why you think these alterations should be made

20) What do you think can be done generally to improve the status of Technical Drawing?

Schools in many countries are, in addition to the drawing board also using
computers (CAD) ie Computer Aided Drawing. Do you see any possibilities of starting Computer Aided Drawing in this school.

THANK YOU

Teachers' and headmasters'open ended questions and explanations.

The teachers' questions consisted of the following twenty items presented according to the objective they belong to :

Objective A

1. **This school has offered Technical Drawing for many years. Are you offering this subject today because its a subject which has always been in existence in this school or is it because you see the value of the subject?**
   Some subjects exist in a school's curriculum just because they have become part of the school's tradition. At times it is simply because the examination board offers an examination in the particular subjects. The question was to establish the main reasons why Technical Drawing is available in the schools. Teachers were expected to explain why they as a school offered Technical Drawing.

b. **How do you think the subject benefits the student both academically and vocationally?**
   Schools offer Technical Drawing either for vocational reasons or purely for educational reasons. This was to see how Zimbabweans view Technical Drawing ie whether they see Technical Drawing as a vocational subject or as a general education subject.

2. **I understand you have started offering 'A' level Technical Drawing. Who initiated this and what are the main reasons?**
b. **How does 'A' level Technical Drawing help students.**
   This was to establish the level of interest in the subject and how they see the value of Technical Drawing.

3. **Do you have streaming in this school?**
b. **If yes which classes take Technical Drawing?**
c. **Are there any subjects which may be taken by students in other streams but not by the stream that takes Technical Drawing?**
   Please list them.
   Does this streaming discourage brighter students from taking Technical Drawing?
   Question 3 was to find out whether Technical Drawing is seen as an intellectually demanding subject or a subject which is taught to the 'D' streams. The same applies to question 4 which sought the teachers' personal view.

4. **For which of the two groups of students do you personally think Technical Drawing is best suited: The academically above average or below average student.**

5. **Can you say Technical Drawing is popular among your students?**

6. **What is the pass rate in this subject?**
Question 5 and 6 were meant to establish the position of Technical Drawing ie whether the subject is popular and whether students spend some time studying Technical Drawing.

7. **Are there any problems you have with Technical Drawing eg shortage of qualified teachers, equipment and books.**
This was to find out the problems which exist in schools with regards to Technical Drawing.

8. **You get an allocation from government for technical subjects. Is this money distributed equally?**
b. **What percentage does Technical Drawing as a subject get?**
c. **Do you have adequate facilities and equipment for Technical Drawing.**
This was to find out whether Technical Drawing was discriminated against or not.

9. **What do you think can be done generally to improve the status of Technical Drawing?**
This question was intended to give teachers the opportunity to state their general views towards Technical Drawing and also to make a contribution towards the betterment of the subject.

10. **Schools in many countries are in addition to the drawing board also using computers (CAD) ie Computer Aided Drawing. Do you see any possibilities of starting Computer Aided Drawing in this school?**
This was to assess headmasters' and teachers' interest and desire to develop technical drawing.

Objective B

1. **Question number 1 as above.**

2. **Do you see Technical subjects as for preparing students for employment or as general education subjects?.**
Attitudes towards Technical Drawing are influenced by people's philosophical position ie whether people see Technical Drawing as a general education subject or as a vocational subject.

3. **Do you think Technical Drawing should stand as an area of study in its own right and not as part of either metalwork or woodwork?**
This was also to determine teachers' views on Technical Drawing as a pre-vocational subject or as a general education subject. Advocates of Technical Drawing as a pre-vocational subject do not accept the complete independence of Technical Drawing whilst advocates of Technical Drawing as a general subject have no problems with Technical Drawing as an independent subject.

4. **If the ministry of education made Technical Drawing a compulsory subject for all secondary school students, would you view this as an acceptable action to take.**
This was to find out whether teachers accept Technical Drawing as a general education subject which should be offered to all students regardless of gender or future career aspirations.

5. **Generally headmasters and teachers use the technical subjects in their schools to show that they are involved in 'education with production'. Do you see Technical Drawing as a 'productive' subject? If so what do your Technical Drawing students do for their education with production?**
This question was intended to find out whether teachers give pupils the opportunity to apply what they learn. This was also to find out whether the theoretical nature of Technical Drawing has any influence on teachers attitudes. Finally this question was intended to determine whether the syllabus content needs changes to make it more practical.

6. **Do you give your pupils an opportunity to apply their knowledge of Technical Drawing to solve other related everyday problems.**
This was to find out whether Technical Drawing concepts are taught as completely abstract concepts or whether they are given a practical relevance.

7. **The university of Cambridge 'O'and 'A' level syllabuses do not include aims and objectives. What are your aims and objectives at 'O' level.**
This was to find out whether schools can clearly state their aims and objectives to show why Technical Drawing is taught in schools. One of the main aims of this question was to establish whether Technical Drawing is seen as a pre-vocational subject or as a general education subject.

8. **As question 9 above.**

Objective C

1. **Are you aware of other types of drawing courses offered by your present examining board?**

b. **Would you change for these if you were given the option?**
This question was to establish teachers views on the present Technical Drawing syllabuses used in Zimbabwean schools.

2. **As 5 in objective B above.**

3. **As 7 in objective B above.**

4. **Which 'O' and 'A' level Technical Drawing topics do you think are the least important and which topics do you think are the most important? Please include reasons.**
   This was to find out teachers attitudes towards the current Technical Drawing syllabus.

5. **Are you aware of the demands of industry in the area of Technical Drawing?**
   If yes please give examples.

b. **Do you have contacts with particular industries?**

c. **If yes do you accommodate their demands or do you limit your teaching to the requirements of the syllabus only.**
   This was intended to find out whether teachers try to make sure that whatever they teach has some relevance and also to find out whether teachers just follow the syllabus without trying to make their subject as varied as possible.

6. **Do you have any other additions or alterations you would want to see made to the present 'O' level Technical Drawing syllabus?**
   Please list them down and also give reasons why you think these alterations should be made.
   This question was intended to give teachers the opportunity to indicate any other changes they would like to see made to the present Technical Drawing syllabus.

7. **As 9 in objective A above.**